MODERN
REFRIGERATION
AND AIR CONTROL

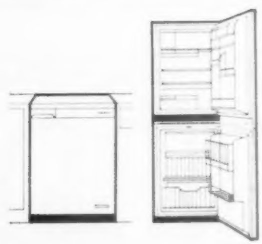
Vol. 64 No. 765 DECEMBER, 1961 Price 2s. 6d. monthly

A

NEW! Kenwood's best-sellers in refrigeration—
FREEZER AND REFRIGERATOR TO MATCH!

KENWOOD FREEZER HF42A   KENWOOD REFRIGERATOR HR52A

BIG CAPACITY-
LOW PRICE!



For the first time ever . . . complete refrigeration in two separate matched units . . . at really down-to-earth prices! The Kenwood **HF 42A meets the growing demand** for a *real* home deep-freezer—**with 4.2 cu. ft. of genuine** sub-zero degree storage. **And the matching Kenwood** HR 52A **Refrigerator packs in a full 5.2 cu. ft. of storage** for all weekly needs. **Superbly designed, expertly planned** to make the most of their big capacity, these two are your best sellers in refrigeration!

Side by side under one double-width table top (optional extra, main illustration) . . . one atop the other (right) . . . under a built-in counter or separately . . . left or right hand door opening . . . the Kenwood pair fit handsomely into any shape or size kitchen!

RETAIL PRICES

FREEZER HF 42A	£60.14.10 + £11.14.2 PT
REFRIGERATOR HR 52A	£51.2.6 + £9.15.6 PT
OPTIONAL WORKING SURFACE (SINGLE)	£3.3.0
OPTIONAL WORKING SURFACE (DOUBLE)	£6.6.0

Every woman wants a

WPS 212

Kenwood Norge 'Never-D-Frost' Refrigerator/Freezers
—the most glamorous refrigerators in Britain!

With these two magnificent models, Kenwood almost makes kitchen larders obsolete! Each has a separate, zero-degree genuine deep freeze compartment—as big in itself as many ordinary refrigerators! And the larder-sized main compartments are entirely self-defrosting. Handsomely styled with brilliantly planned and fitted interiors, these two meet the public trend towards real home deep-freezes *and* bigger-capacity refrigerators combined!

KF 13

nearly 3½ cubic feet Deep Freeze capacity (over 1 cwt)
13.3 cubic feet capacity
20.9 square feet shelf area
RECOMMENDED SELLING PRICE **£189.0.0**

KF 12

nearly 2 cubic feet Deep Freeze capacity (over ½ cwt)
12 cubic feet capacity
18.3 square feet shelf area
RECOMMENDED SELLING PRICE **£155.0.0**

For full information and details of generous co-operative advertising terms, write to Dept. MR. 35

KENWOOD MANUFACTURING (WOKING) LTD · OLD WOKING · SURREY
One of The Kenwood Group

Kenwood kitchen!

An aerial photograph showing the vast single span roof of the new "Birds Eye" Cold Store at South Denes.

Lyons choose the

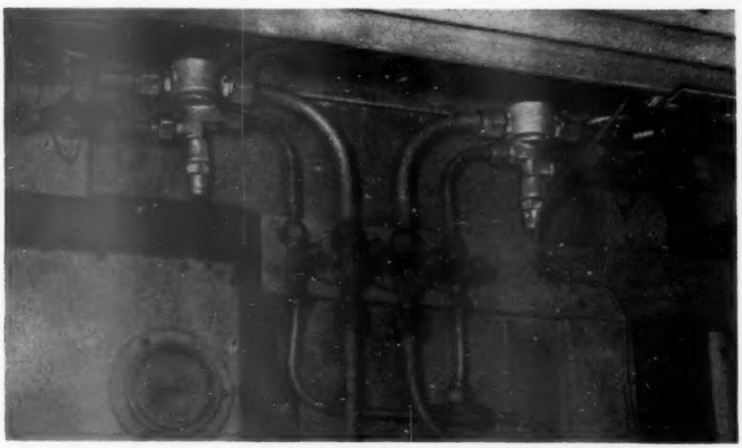
Teddington RD

FOR 4 GOOD REASONS

The transportation of ice cream allows for no failures, and weather fluctuations put extra heavy strain on refrigerated vehicles. So when it comes to expansion valves Lyons come to Teddington. And there are 4 good reasons why:

* **The RD has no capillary, so vibration cannot cause fatigue or fracture.**
* **The RD can be fitted inside the van and cannot reverse.**
* **The RD requires no external equaliser as the suction gas is in direct contact with the bellows.**
* **The RD gives perfect control of superheat under all conditions.**

Photographs by courtesy of J. Lyons & Co. Ltd.

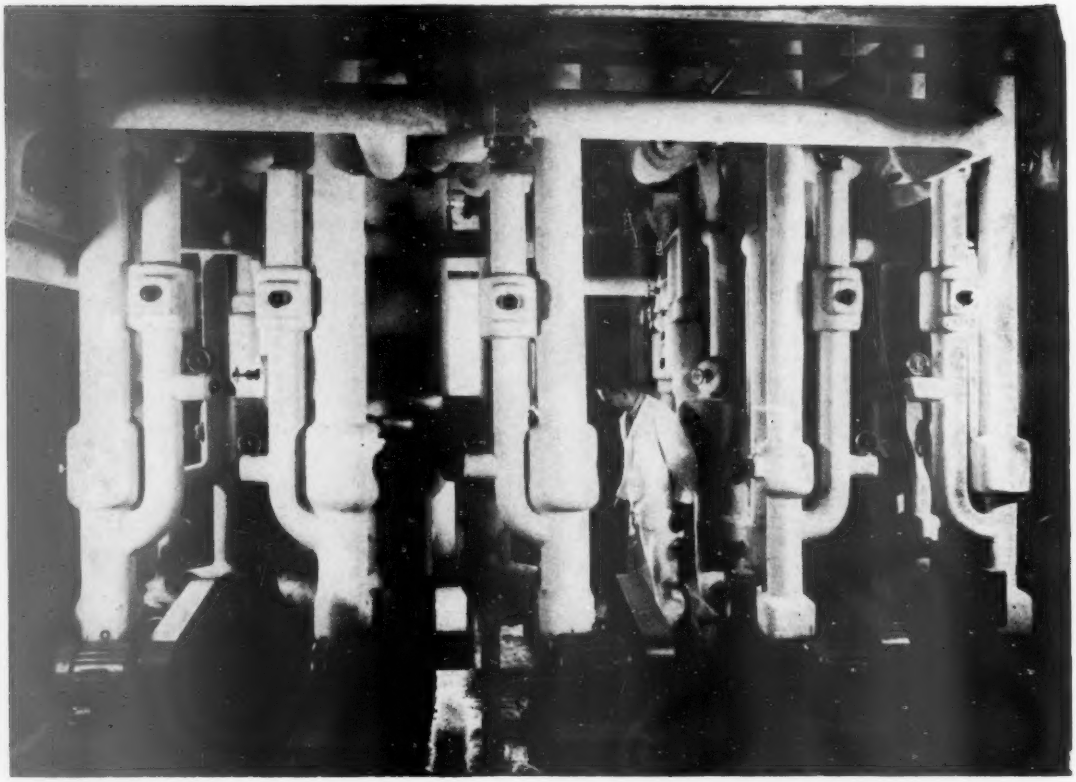


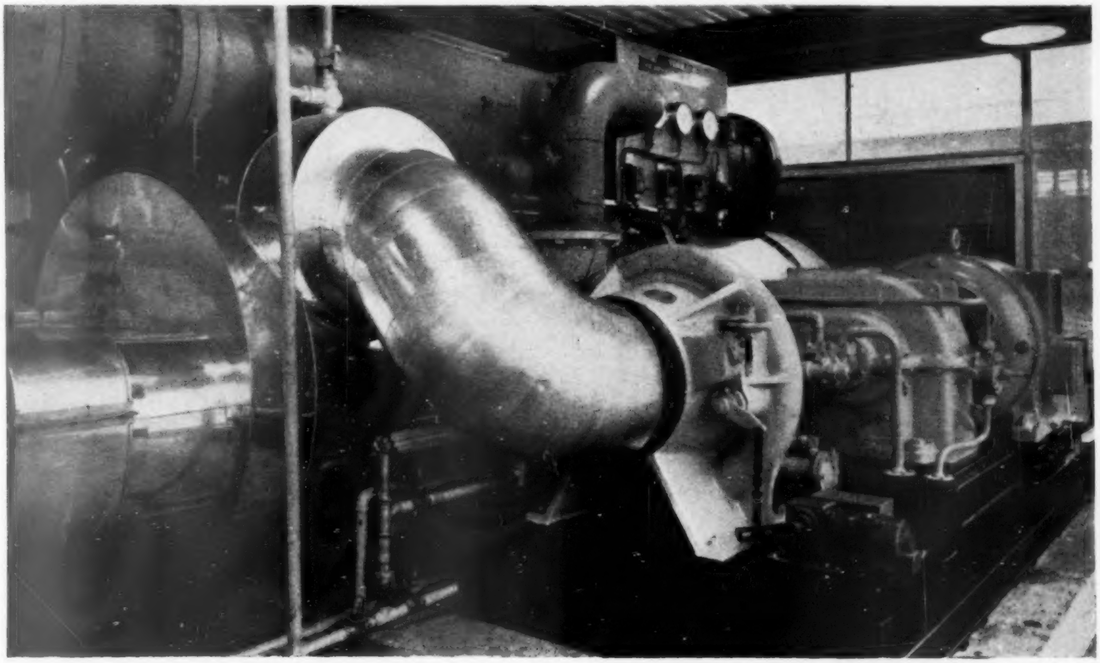
Teddington RD THERMOSTATIC EXPANSION VALVES

TEDDINGTON REFRIGERATION CONTROLS LTD · SUNBURY-ON-THAMES · MIDDX

TELEPHONE: SUNBURY 456

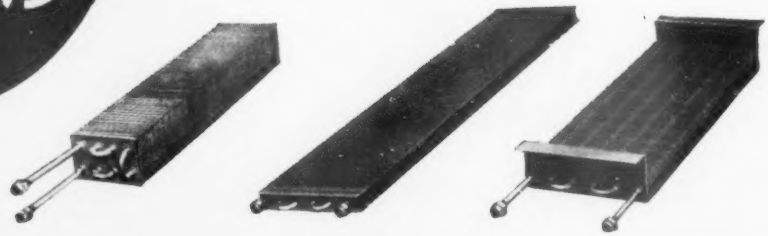
TR104





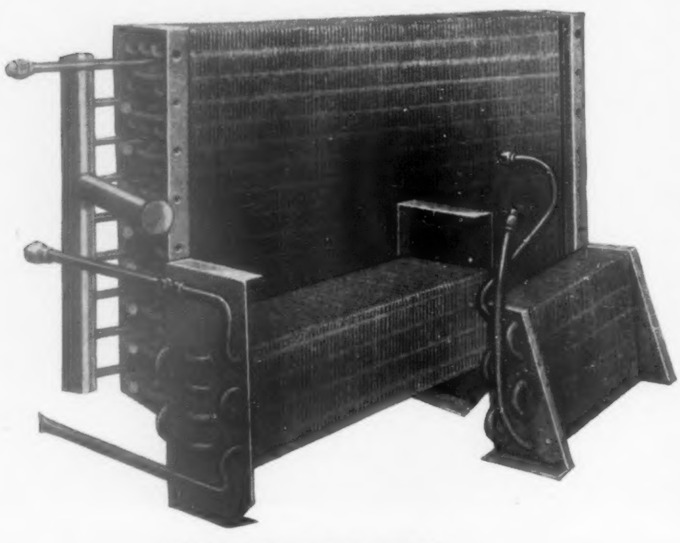
use RA PRODUCTS

Manufacturers of Coolers and Condensers for Commercial, Industrial Refrigeration and Air-Conditioning Applications

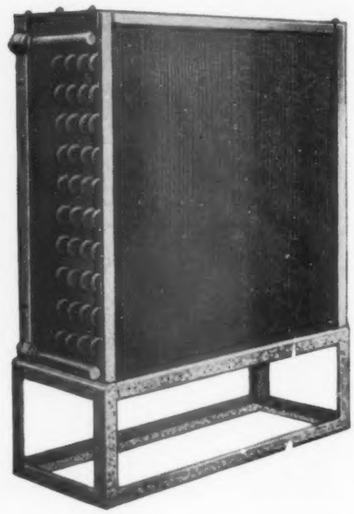


FINNED COOLERS

FOR :—DISPLAY CASE, COMMERCIAL and INDUSTRIAL APPLICATIONS



FINNED COOLERS
FOR AIR-CONDITIONING APPLICATIONS



FINNED TYPE
AIR COOLED CONDENSERS

REFRIGERATION APPLIANCES LIMITED

Head Office · 11-15 TUDOR ROAD · HACKNEY · LONDON · E.9

Telephone No. AMHerst 9747-8-9 Telegrams : CHILLYHACK, LONDON

when you need

WATERTIGHT OR AIRTIGHT FASTENERS

choose

'IMEX' BLIND RIVETS

The 'Imex' Rivet offers all the advantages of the well known Tucker 'Pop' Rivet in that it can be set by one operator, in one operation, working from one side of the material only.

The additional advantages of the 'Imex' Rivet are that it has a sealed end and this combined with a high rate of radial expansion in setting ensures a joint which is vibration proof and pressure tight. Also a completely flush finish to the rivet can be obtained if required.

'Imex' Rivets are manufactured from aluminium alloy and copper, and are available in diameters of 1/8", 5/32" and 3/16" for riveting material up to 3/8" thick.

The riveting of bus roofs shown above is typical of the many applications where the 'Imex' Rivet fills the need for a speedy, economical watertight sheet metal fastener.

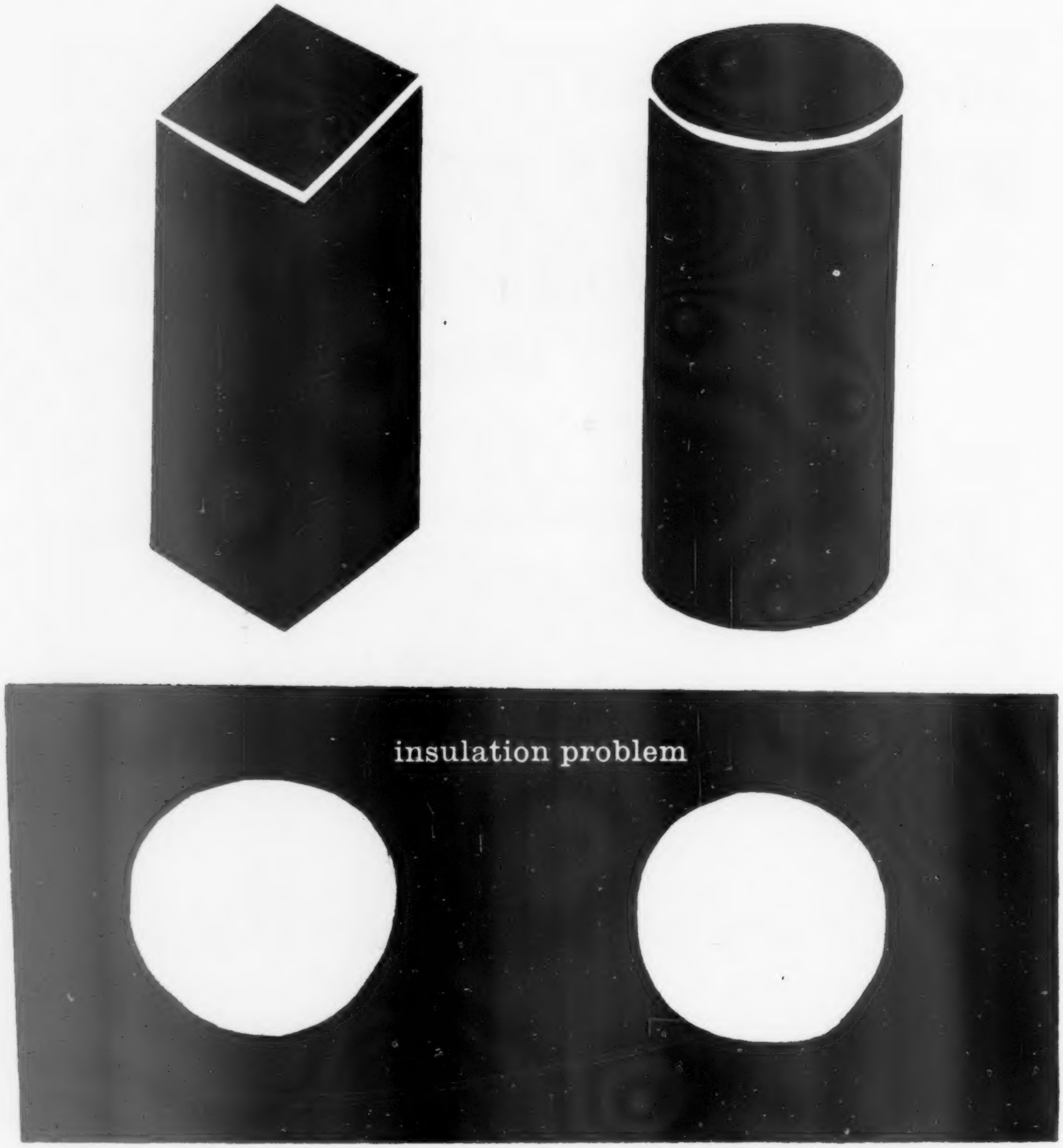
Photos. by courtesy of W. Alexander & Co. Ltd., Falkirk and Scottish Omnibuses Ltd.

Geo. **TUCKER EYELET** Co. Ltd.

BIRMINGHAM 22b

Phone: BIRchfields 4811 (9 lines). *Grams: Eyelets, Birmingham.* *Telex: 33480*

The trade mark 'IMEX' is registered in respect of rivets in the United Kingdom and many other countries in the name of Geo. Tucker Eyelet Co. Ltd



think Rocksil—Want it resilient, flexible, light and inexpensive? Think Rocksil. More and more of today's cookers and refrigerators are being fitted with **Rocksil** insulation. We have full technical data ready for you. Just ask us.

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TA 5105

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PEOPLE WEAR GENTLEMEN-WE'VE-SOLVED-IT-IN-ONE FACES WHEN YOU GET THE STORY ON

STERNITE has already solved a lot of problems for people who use polystyrene. We believe it could solve a lot more, in the Refrigeration industry. Why not ask for those data sheets *now?*
Sternite toughened polystyrene for sheet extrusion and injection moulding applications.

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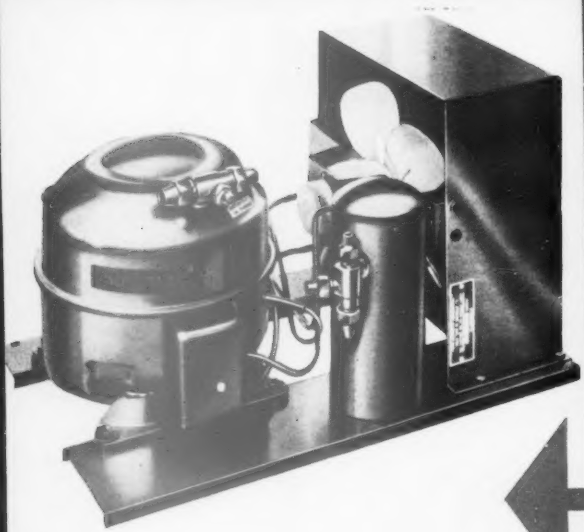
wish all their friends
both at home and abroad
hearty Greetings
for Christmas
and the New Year

FARLINGTON · PORTSMOUTH · ENGLAND

More B.T.U's PER WATT!

new economy base plate buys you a cheaper and more compact unit



and the latest addition to this extensive range of conde

ONAN

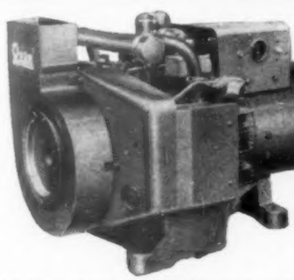
THE GENERATING SET *ENGINEERED* FOR REFRIGERATED VEHICLES

Onan Vacu-Flo cooled packaged Generating Sets provide ample power for the operation of electrically driven open and sealed type refrigeration units giving High Performance with long life, minimum operating and maintenance costs.

VACU-FLO COOLING SYSTEM

Exclusive to Onan — overcomes cooling problems in confined space. Cooling air is drawn through and over the generator and engine and exhausted through an outside duct.

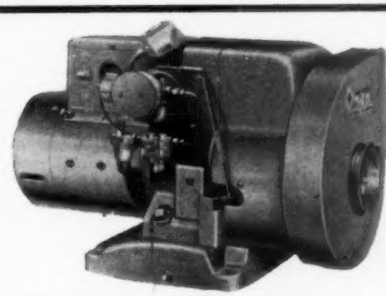
Built by Messrs. Blox Services Ltd., this Refrigerated Truck is operated by Flying Goose Ltd., for transporting frozen poultry. The electrical power, for the refrigeration equipment, is supplied by an Onan Model 305 CCK. After exhaustive tests, leading Manufacturers of Refrigeration Equipment recommend Onan Generators exclusively.



ONAN 5 CCK GENERATOR WITH VACU-FLO COOLING

gives 5 k.w. of packaged power and will handle refrigeration units of up to 3 h.p. Model 305 CCK meets the requirements of units up to 2 h.p.

LOOK AT THE WEIGHTS—5 k.w. Model ONLY 375 lbs., 3½ k.w. Model ONLY 314 lbs.



ONAN MODEL 205AJ-2RV WITH VACU-FLO COOLING

Ideal for mounting in sound-proofed compartment in Refrigerated truck or mobile shop for the operation of Refrigeration Compressors up to ¾ h.p. Frozen Food Display Cabinets or for providing power and light for mobile sales and display vehicles. Built for long life and quietness of operation. Full details on request.

Most models available ex stock. Our After Sales Service is unmatched by any other suppliers.

G.M. POWER PLANT CO. LTD.

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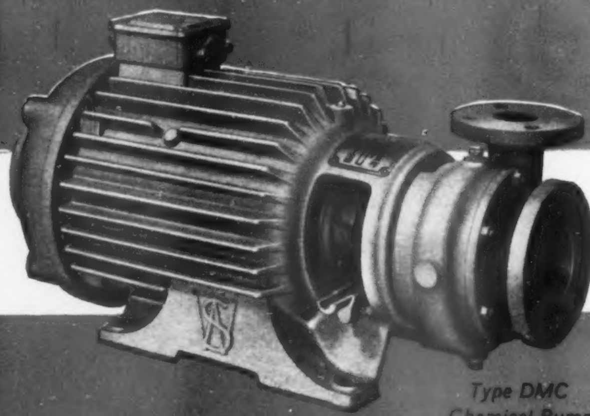
4 BIG ADVANTAGES

OF WORTHINGTON-SIMPSON 'MONOBLOC' PUMPS

1 space-saving 'Monobloc' construction ensures easy installation and perfect alignment.

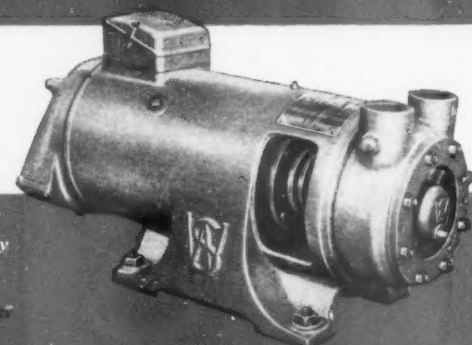
2 comprehensive range of sizes—from 3 to 1,200 g.p.m. —heads up to 210 feet— 45 sizes of motor.



Type DMC Chemical Pump

3 freedom from vibration.

4 range of stainless steels available for handling liquors without risk of contamination.



Type TM Vortex Pump

Other Worthington-Simpson equipment for industry includes:

'VORTEX' PUMPS
—for boiler feed service and many other applications requiring high heads and limited capacities.

VERTICAL SIMPLEX AND HORIZONTAL DUPLEX PUMPS
—ideal stand-by pumps for boiler feed services.

NON-LUBRICATED AIR COMPRESSORS
—for oil-free air supply.

CONDENSING, FEED-HEATING AND DE-AERATING PLANT

We shall be glad to send technical literature containing full specifications.

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Worthington - Simpson Ltd

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P.4873

Original SIEVERT

(Bottled Gas)

L. P. GAS APPARATUS

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The higher temperature of propane ensures high sensitivity through rapid heating of indicating element and permits use as brazing torch with silver alloy solder.

The ESSENTIAL tool for hermetic compressor exchange and general workshop duty.

Instantaneous, no warming-up time needed.

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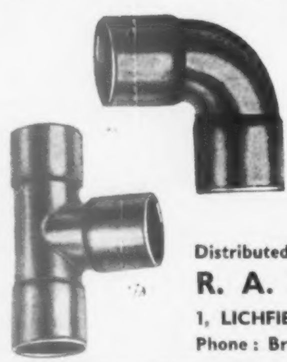
Now available in England

NIBCO (SWISS PRECISION) All-Copper *STREAMLINE* FITTINGS



¼″ to 4⅛″ od.

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ANY LENGTH : ANY FEMALE FLARE CONNECTIONS

★ Standard (250 psi) for F-12, CH_3Cl.

★ HEAVY (1,000 psi) for F-22, F-13, etc.

7 - 10 days certain delivery.

One off or quantities as required.

Quotations on request.

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TEMKON
auto-defrost refrigeration
for cold store applications
TEMKON REFRIGERATION
TEMPERATURE RANGE:
−5°F to 38°F (water cooled)
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Completely automatic hot gas defrost
Entirely self-contained with hermetically sealed refrigeration system
Easily installed in any cold room.
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Low in cost and economical in operation
For butchers and meat storage
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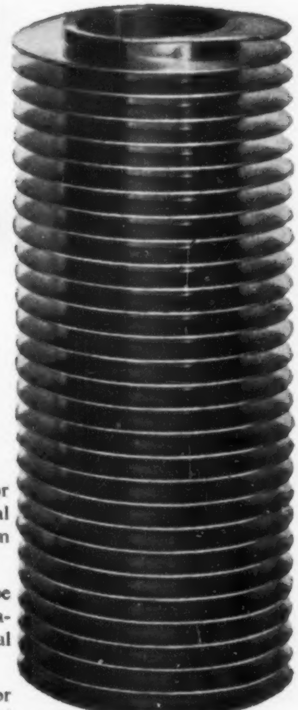
BURLINGTON ROAD FULHAM LONDON S.W.6 ENGLAND PHONE RENOWN 5813 (P.B.X.) CABLES TEMTUR LONDON
MAKERS OF THE WORLD'S QUIETEST ROOM AIR CONDITIONER

P6039

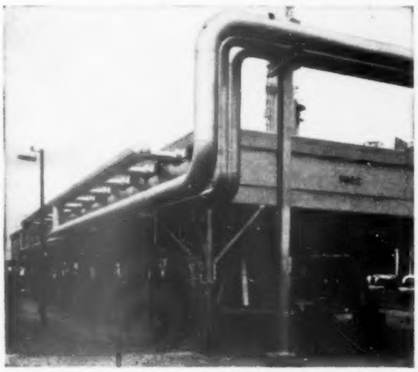
'INTEGRON'

the tube with the integral fin



Reliable, efficient—VERSATILE, TOO!

For heat exchange tubing, absolute reliability and maximum efficiency are essential. ICI 'Integron' combines them with impressive versatility—a wide choice of materials, fin heights and spacings, tube diameters and finishes.



More than 150,000 ft. of 'Integron' M.F. aluminium finned tubing is used in the air cooled condensers of the Powerformer unit at Fawley Refinery. Built by A. F. Craig & Co. Ltd. and supplied to Esso Petroleum Co. Ltd. by Hudson Engineering Corporation.

For instance—

'INTEGRON' HIGH-FIN tubing for generator alternator and transformer coolers in the electrical industry, air coolers in the chemical and petroleum industries.

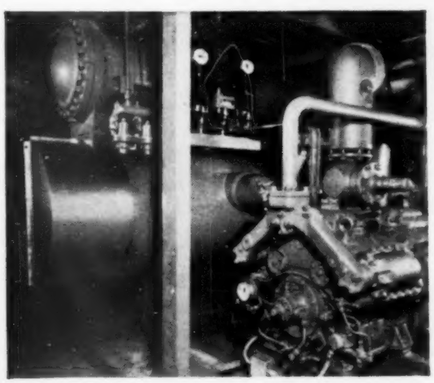
'INTEGRON' LOW-FIN tubing for shell-and-tube condensers and heat exchangers in the refrigeration, air conditioning, petroleum and chemical industries.

'INTEGRON' M.F. aluminium-finned tubing for air cooling in the petroleum and petro-chemical industries.

For full details of 'Integron', the unique extended surface tubing, contact your nearest ICI Sales Office.

'Integron' High-fin copper tubing is used in the gas coolers of hydrogen cooled generators built by C. A. Parsons & Co. Ltd. Each stator casing has four coolers mounted longitudinally in the upper half of the casing behind the core.

INT 13



York Shipley Ltd. specified 'Integron' Low-fin copper tubing for the 125-ton package-type water cooling system forming part of the air conditioning plant at the new American Embassy in London.

ICI METALS DIVISION

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First three volumes of a new series of Refrigeration Manuals

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A Book of instruction on The Engineering, Physics and Biology of Refrigeration
Heat and its Measurement · Heat Laws · Vapour Compression · Further Aspects of Power Computation
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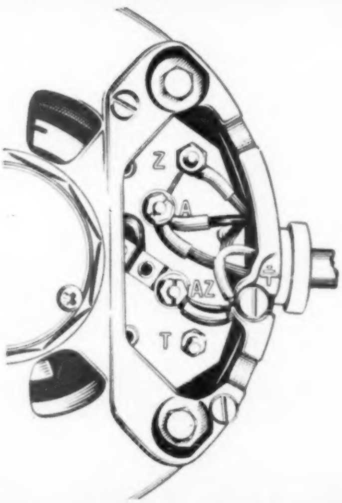
This thing called know-how



Take the rear cover of one of our F.H.P. motors. It looks ordinary enough but it is in fact a remarkably successful piece of detail design. Within its small diameter, room has been found for a terminal box far larger than is usual on F.H.P. motors (which makes installation quicker), a very large oil reservoir for the bearing (which reduces maintenance) and large ventilation openings. Moreover, the cover has to be made at a competitive price. This kind of design comes of experience, and a great deal of unwritten knowledge is built into it.

Crompton Parkinson LIMITED

ELECTRICAL EQUIPMENT

Makers of Electric Motors of all kinds, A.C. and D.C. Generators, B.E.T. Transformers, Switchgear, Cables, Instruments, Lamps, Lighting Equipment, Batteries Stud Welding Equipment, Traction Equipment, Ceiling Fans.

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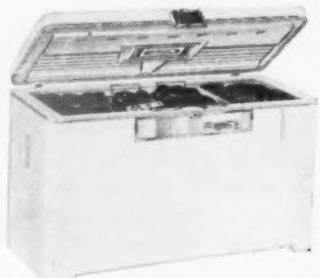

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Quicfrēz® Inc.

range of Freezers and Domestic Refrigerators

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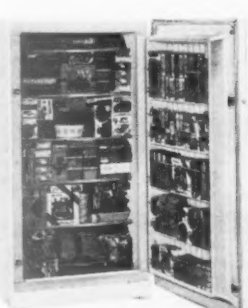

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SOLE AGENTS FOR THE U.K.

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Owing to the ever increasing production costs, the publishers of **MODERN REFRIGERATION** regret that they are compelled to make a slight **increase** in their charges for Classified Advertisements. As from the **November** issue all headings will be **9d.** per word; **Minimum 15/-.**

SITUATIONS VACANT

9d. per word. Minimum **15/-.** Box **2/-** extra.

COMMERCIAL Refrigeration Sales Representatives required by expanding Company to sell in West London area. High basic salary and commission with Company car for men with proven sales record. Phone for appointment. R.E.M.S. Ltd. VIK 3456. 051

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AIR CONDITIONING DESIGNERS. Excellent prospects with large Glasgow company for several experienced designers with knowledge of land or marine installations. Refrigeration experience desired but not essential. Must be used to working on own initiative with minimum supervision. Superannuation scheme in operation. Attractive salaries will be offered to suitable applicants. Interviews arranged, if desired, outwith normal working hours. Box 033.

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Leading Middle East Air Conditioning firm require highly skilled refrigeration erection man. Experience in centrifugal compressors essential. Initial contract three years with possibility of permanency. Single or married men acceptable and families may accompany successful applicants. Salary of up to £200 per month plus car, air conditioned living quarters. Please write fully to Box 053.

APPLICATIONS invited for position of Area Supervisor in S.W. London district. Applicants must have experience in selling commercial refrigeration equipment. Apply in writing to: Trembath & Co. (Sales) Ltd., Purley Way, Croydon, Surrey. 035

SERVICE ENGINEERS required

PAY **£15 p.w.** (5 day week)
PLUS COMMISSIONS
PLUS NON-CONTRIBUTORY PENSION SCHEME
PLUS OVERTIME at OVERTIME RATES

Applications to:

**THE SERVICE MANAGER,
TREMBATH & CO. LTD.,
PURLEY WAY, CROYDON, SURREY.**

FRIGIDAIRE DISTRIBUTORS

002

REFRIGERATION Consultant/s required, qualified to advise on display cabinet construction, medium and low temperatures. Box 068.

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9d. per word. Minimum **15/-.** Box **2/-** extra.

CHIEF ENGINEER with 25 years' experience of Installation and Servicing of industrial and commercial refrigeration plant (all systems) seeks responsible position where ability and initiative are encouraged. Replies to Box 039.

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EXPERIENCED Refrigeration Engineer, executive and administrative level. Twenty-five years' practical experience in design, sales and office management and general organisation. Seeks position where these attributes could be fully utilised. Box 059.

REFRIGERATION Cabinets second-hand, between 1¼ to 40 c.ft. The A.C.R.E. Company, 389 Green Lanes, London, N.4. MOU 0171/2. 1364

REFRIGERATED Vehicles for disposal complete with compressors, etc. For use as operative vehicles or static cold storage units. Box 356.

DISPOSAL. All A1 condition and subject to inspection. Compressor by Brotherhood D/A Single cylinder 9 x 9. Power Plant D/H Reduction Gear for 100 h.p. 575 to 255. Two Holmes/Reyrolle A/C Slip ring Motors. 90 h.p. and 140 h.p., 3 p. 440 v. 580 r.p.m. and Ditto 580 r.p.m., etc. Also all Spares for Linde/Lightfoot Horizontal Compressor, Con. Rods, Valves, etc. Robinson Cold Stores, Newcastle on Tyne, 6. 042

SERVICE & REPAIRS

9d. per word. Minimum **15/-**. Box **2/-** extra.

SERVICE repairs and overhauls all types of equipment. Sealed Unit Mechanisms a speciality.—Wilde & Clayton (Refrigeration) Ltd. Forest Hill 8851. 341

REPAIRS and general maintenance effected for the trade. Specialists in absorption and Sealed Unit Mechanisms. The A.C.R.E. Company, 389 Green Lanes, London. N.4. MOU 0171/2. 004

AGENCIES, REPRESENTATIVES ETC.

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Refrigeration Division
SALES REPRESENTATIVES

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NATIONAL concern with proved market (both home and overseas) for unique product, selling at high price, wish to contact manufacturers interested in quoting for long-term quantity production, largely in metal. Box 069.

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MODERN REFRIGERATION

and Air Control

Incorporating
COLD STORAGE AND PRODUCE REVIEW
and ICE AND COLD STORAGE

Established 1898

VOLUME 64 NUMBER 765

DECEMBER · 1961

Contents

MODERN REFRIGERATION Overseas

The world-wide circulation of this, the original and oldest Journal of the British Refrigeration Industry, carries "MODERN REFRIGERATION" by postal subscription into the following countries:—

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"M.R.," now in its 64th year of publication, has built up for its overseas readers special subscription and sales agencies in all the above territories.

★

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Refrigeration Press Ltd.
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Compliments of the Season
to Readers and Advertisers
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Editorial

● What a change the advent of quick-freezing, and particularly immersion freezing, has brought to the turkey industry. This was very evident at a gathering of the British Turkey Federation last month when the pre-Christmas market was assessed for the enlightenment of the national press. Col. U. Corbett, B.T.F. chairman, declared that during the year the turkey industry continued to expand and to increase in efficiency, with three main effects. At Christmas there would be more turkeys available, they would be of better quality and an increasing proportion would be processed by the industry for sale as quick-frozen oven-ready birds, thus helping to fulfil the aim of the industry to offer better value in quantity, quality and presentation.

● Last year the proportion of quick-frozen oven-ready turkeys was about half the total supply; this year it will be at least 60 per cent. of the birds on offer. There is no doubt that this side of our industry will continue to expand and will provide turkeys not only at Christmas but all the year round.

● There has arisen, during the last ten months, a vast new perishable food entrepôt in East London, capable of holding over 10,000 tons of comestibles. This cold store is based on Swedish designs for, indeed, its owners are of that nationality. Salient features are single-storey construction, prefabricated insulated panels for inner walls, "Freon" as the refrigerant (a departure in itself with this size of this store) and an enormous marshalling yard for road vehicles. Close attention will be paid in this store to precise control of humidity so that its contents—a large proportion will be meat—are subjected to ideal conditions, with minimal weight loss. The building is described in this issue.

● A break-away in the method of constructing refrigerated and insulated vehicles, which eliminates the need for a basic timber body framework, has been made possible by the use of a high strength, lightweight, closed cell expanded polyvinyl chloride, called Plasticell. For this application the Plasticell is skinned with 20g aluminium and bonded with a bitumastic resin adhesive, the joints in the insulating material being joined to form a complete body section. The high strength and low weight of this material—it plays the dual role of a structural core as well as an insulating medium—has been used to achieve panels of extreme rigidity and lightness. One grade has a compression strength of 40 p.s.i, a density of 2.5 lb. per cubic foot, and a "K" value of approximately 0.2 B.t.u./inch/sq.ft/°F. Also, vapour permeability is as low as 0.0026 grains/sq.ft/1 in thickness/millibar—equivalent to some vapour seals.

● The therapeutic uses of refrigeration have often been dealt with in these columns and now comes the news of a further application of cooling plant in this field. To ensure an absolutely regular flow of water through the heat exchanger of a heart-lung machine, a centrifugal pump has been incorporated in the heat exchanger control trolley which provides accurate control over the rate of cooling and warming of the blood. Several more of these sensitive machines have been ordered by some of the larger hospitals for use in major heart surgery.

● If the blood temperature of a patient is reduced to 15°C., the metabolic rate is also reduced, which allows open-heart surgery of any kind. The heart-lung machine consists of a hypothermia trolley which has two blood reservoirs and a heat exchanger. The heat exchanger is fed with water from two pipes emerging from the control trolley standing adjacent to the hypothermia trolley. The patient's blood is extracted from the femoral artery, pumped through the reservoir to one end of the heat exchanger, through one side of the exchanger and returns to the vena cava from the other end. Cooling or warming water is pumped through the heat exchanger from the control trolley and this regulates the temperature of the blood. By this means the patient's blood may be reduced to a temperature low enough to make operating procedure on the heart safe. When the operation is completed, the same heat exchanger is used to warm the blood again at an even rate, and both these processes are governed by the accurate control of the water being circulated.

● Mr. Russell Gray, president of Carrier Air Conditioning Company, Syracuse, N.Y., was elected president of the Air-Conditioning and Refrigeration Institute, at its annual meeting last month. He succeeds Mr. R. K. Serfass, manager of the Westinghouse Electric Corporation's air-conditioning division, Staunton, Va., in the presidency of the trade association of the industry, having been a vice-president of ARI for the past two years. This meeting was held at Hot Springs, Va., which seems to call for a considerable amount of air-conditioning. This prompts us to set down on this page, unequivocally and unreservedly, the request that the meeting halls and banquet venue at the next International Refrigeration Congress in Munich in 1963 *should be air-conditioned*. It is not too early for those responsible to be thinking about this subject *now*. For many years

it has been our lot to sit at these congresses in tropical heat to listen to papers on the delights of refrigeration and air-conditioning; surely, the protagonists of the art do not need convincing of the benefits accruing from the use of their own products?

● The problem of cooling off reasonably sedentary congressists (even if there happen to be over 1,000 persons in one place at one time) should not be insurmountable, particularly when one reads that the playing of badminton in the church hall at Bahrein is now possible! (there the summer shade temperatures hover between 110° F. and 115° F.) A fine, modern building, the hall is used as a school for European children during the day. So effective are the three air-conditioning units, employed in conjunction with sound architecture, that the interior temperature has never risen above 76° F. Outside school hours, the local community have been able to play badminton in the building, an activity which previously had been unthinkable. Our manufacturing friends at Maidstone were responsible for this plant.

CORRESPONDENCE — REFRIGERATION EDUCATION

TO THE EDITOR—

SIR,

I have read with great interest the article in the November issue entitled " Refrigeration Education in Britain To-day " by R. W. Webb, B.SC. (ENG.), and noted the comment with regard to the reason for very poor support throughout Britain for the City and Guilds course 72.

The writer states that possibly the reason is that four years' study with comparatively little gain other than increased knowledge does not appeal.

I am myself connected with the course for the above examinations operated by the Nottingham People's College of Further Education which is in the main supported by apprentice service and installation engineers from local refrigeration firms. It seems to me that this is the most suitable course for this type of student and he ought to acquire considerable gain on successful completion of this course as qualifications of any description other than perhaps one or two subject O level G.C.E. are not by any means commonplace among apprentices of this description.

I would be very pleased to receive comments on the general feeling on this aspect and what is generally considered suitable qualifications for the average service and installation engineer, what gains such a qualified engineer should receive.

Yours etc.,

A. J. HALL.

" Highdale,"
4, Barnet Road, Nottingham.

SIR,

I was most interested to read the article on refrigeration education in the November issue.

That there is the need for the " powers that be " to take some real interest in this matter is known all too well.

The facilities for the serviceman to take the course 72 are nothing like what is required to enable one to go through with a good chance of obtaining the desired results; hence the " sorry reading " as quoted in the article.

I obtained a first class certificate (Inter) in 72 in 1952 and have never had the opportunity to go any further in my own town.

Refrigeration is undoubtedly the " also-ran " in the education field.

Yours etc.,

H. JAMES.

21, Seaford Avenue,
Wollaton Road, Nottingham.

"Blood Bomb"

DR. Howard O. McMahon, science director of Arthur D. Little, Inc., Cambridge, Massachusetts, a leading scientific research group in the United States, has recently developed a new type " blood bomb," a cylinder of heavy-gauge steel about 18 in. tall and 5 in. in diameter, in order to preserve biological materials for long periods of time. Such material might include blood, vaccines, sera, enzymes, and hormones, and various living biologicals such as molds, bacteria, and tissues.

Biologicals kept at moderate refrigeration will last for only short periods. They cannot be frozen, for as they change to the solid state, their structure is altered, and they are rendered useless.

If, then, blood or other biological material could be cooled below its freezing point in some manner that it would not freeze, its structure might not be damaged.

The new " bomb " ideally would serve such a purpose. It is based on two physical phenomena :

1. When water or a water solution freezes, it expands ; therefore, when water is compressed, its freezing point is lowered.
2. The freezing point of a solution such as a biological material is always slightly lower than pure water.

In practice, the new blood " bomb " operates as follows: the material to be studied is sealed inside a plastic bag and placed in the cylinder. The remaining space in the cylinder is filled with cold water near the temperature of its maximum density (4° C.). When the sealing head of the cylinder is closed, all free air is automatically expressed, leaving the cavity of the cylinder completely filled with water. As the cylinder cools below 4° C. the water expands and exerts sufficient pressure on the test material within the plastic bag to prevent freezing of the contents. As the bomb is cooled further, some of the pure water turns to its first ice phase, Ice I, expanding still further in so doing. This continued expansion puts increasing pressure on the test material, progressively lowering its freezing point. The limit of the process is -22° C. and 2,200 atmospheres (33,000 lb. per sq. in.) when Ice III forms.

Since the test material has a slightly lower freezing point than water, it can be cooled to this temperature without freezing.

Other than the work of the refrigeration compressors, no mechanical energy is required to operate the bomb.

The device was turned over for experimentation to Dr. Ivan Brown Jr., associate professor of surgery at Duke University School of Medicine, and his associates.

The effects of hydrostatic pressure on certain biological material and biochemical processes have been studied by a number of investigators.

Because of its simplicity, the "bomb" makes possible temperature observations over any exposure period without undue fluctuations and would permit the construction of large cylinders with their own refrigeration units capable of holding considerable material at one loading.

NEWS OF THE MONTH

Refrigeration and A-c Exports.—During October, 1961, air-conditioning and refrigerating machinery and fans (commercial and industrial sizes) to the value of £636,566 weighing 831 tons were exported from the United Kingdom. Comparable figures for October, 1960 were 775 tons, worth £574,684.

* * *

Exports' Analysis.—Of the 831 tons of air-conditioning and refrigerating plant worth £636,566 exported by Great Britain in October—quoted in the preceding paragraph—33 tons went to the Union of South Africa, 75 tons to India, 48 tons to Australia, 30 tons to New Zealand, 26 tons to Canada, 142 tons to " other Commonwealth countries," 93 tons to Eire, 12 tons to Sweden, 50 tons to Western Germany, 47 tons to the Netherlands, 32 tons to Belgium, 62 tons to France, 15 tons to Italy and 166 tons to " other foreign countries."

* * *

Refrigeration Plant Classified.—Of the total exports of air-conditioning and refrigeration machinery during October, commercial refrigerating machinery accounted for 48 tons worth £32,292, industrial plant and equipment for 147 tons worth £91,112, and refrigerating machinery, equipment and parts for 399 tons worth £308,773.

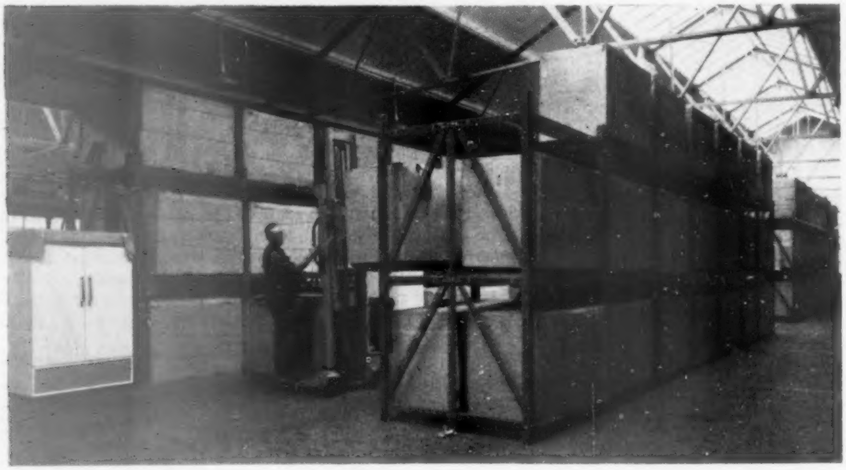
* * *

Exports of Small Refrigerators.—During October, 1961, 590 tons of complete refrigerators and domestic refrigeration equipment were sent overseas from Great Britain. These exports were worth £394,520. The 590 tons comprised 12 tons to the Union of South Africa, 6 tons to Rhodesia and Nyasaland, 24 tons to New Zealand, 28 tons to Canada, 237 to " other Commonwealth countries and Eire," 17 tons to Sweden, 1 ton to Western Germany, 4 tons to Italy and 261 tons to " other foreign countries."

* * *

Pallet Racking for Cold Store and Factory

Heavy duty Dexion pallet racking is being used in one of the largest cold stores in the country. Andrew Johnson Knudtzon Ltd., of Hull, chose racking of Dexion slotted angle to give them selectivity and maximum use of the valuable space available. The section illustrated above is a double-entry run of racking 30 ft. long by 14 ft. 6 in. high. The bays are designed to accommodate 4 ft. by 4 ft. pallets—112 in all. Each bay takes a loading of one ton. The temperature within the store is constantly at minus 20° F. The whole installation took 7 warm-blooded members of the Dexion construction service 5 days to build ! The illustrating on the left shows the use to which Prestcold put Dexion. (*See page* 1255).



REFRIGERATION FOLLIES

. . . No. 9

...and a Happy Christmas to you!

PICTURE OF THE MONTH ★

Alf Meade Ltd., of Reading, are one of the largest privately owned slaughterers and wholesale fresh meat traders in England, with a fleet of refrigerated vehicles carrying bulk supplies of meat to Smithfield and many cities in the north of England. Included in this fleet are Sparshatt-bodied Leyland Comets and a six-wheel Smiths-Litex bodied ERF, all fitted with Thermo King M20 units manufactured by Petters at their Hamble factory. The latest addition is a Sparshatt-bodied, eight-wheel Foden vehicle, with M20 units installed, whose average load is 80 sides of beef. When meat has to be stored pending delivery to customers, the Thermo King units are connected to the abattoir's electricity supply and the carcases can then be hung in the vehicles for periods of up to two days. Every week an average of 750 beef carcases pass through the abattoir—and through the hands of Mr. Alf Meade, M.B.E., chairman of the company, who still works with his men as the final dresser on the beef line.

Air-Conditioning for Television

COMFORT IN NEW HERTFORDSHIRE STUDIOS

TELEVISION production in the modern studio demands a high rate of concentration, and more importance is being attached to the conditions under which producers and their assistants are called upon to work. In the production control rooms of A.T.V's new television studio centre at Borehamwood, Hertfordshire, the designers have set out to provide conditions of maximum comfort by the provision of air-conditioning.

Work on the new centre was started in January, 1960, and is expected to be completed at the end of this year when it will have cost approximately £3,000,000. The architects for the whole scheme were Stone, Toms & Partners, with Sir Robert McAlpine & Sons, Ltd., the main contractors. The consultants for the mechanical services were G. H. Buckle & Partners, while Rosser & Russell Ltd., were responsible for installation. Refrigeration plant for the air-conditioning services was supplied and installed by York Shipley Ltd., North Circular Road, London N.W.2.

All the facilities required for television production are grouped in the 340,000 sq. ft. of development area. It includes a studio facilities building for the storing, handling, and creation of scenery and "props"; a technical facilities building which contains the central apparatus room together with the central pulse generating and distributing equipment, telecine and video-tape recording apparatus; transport and workshop facilities, administration and rehearsal room block, and studios.

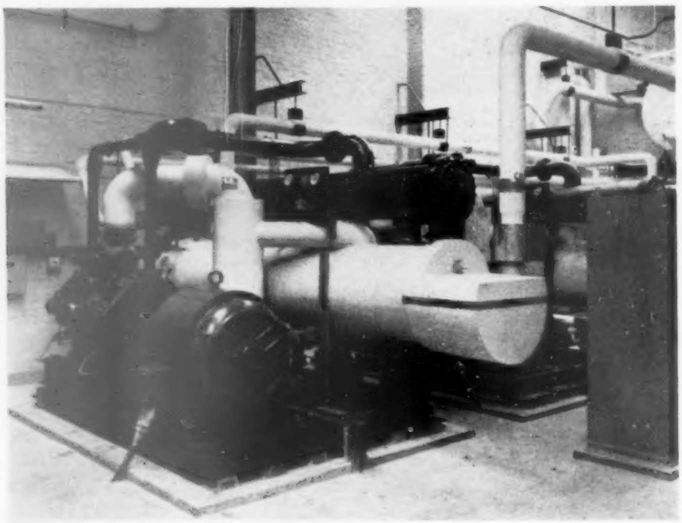
The studios, including directly associated control areas, have a total area of 54,000 sq. ft. Studios A. & B., which have yet to be completed, are 6,250 sq. ft. and 6,500 sq. ft. respectively, while studios C and D are each 9,250 sq. ft. The facilities directly required for the operation of C and D are contained in a four storied building between the two. The control rooms for each are placed diagonally in the corner at first floor level. On the ground floor are quick-change wardrobe and make-up rooms and equipment stores, the second floor houses the dimmer rooms and lamp stores, while the ventilation and air-conditioning ancillary equipment is located on the third floor.

Air inlet for the studios incorporates a 72 in. centrifugal fan, an "Ozonair" filter and steam heater battery. Distribution is through a high level ring main ductwork system, acoustically treated, with drops down to diffusers. Air extract is through a high level main in the ceiling centre. Recirculation is arranged through a thermostatically controlled damper.

Conditioned air for the control rooms enters through ceiling diffusers from Dunham-Bush heater/cooler units. Two centrifugal fans recirculate air, with a proportion of fresh air, from high level inlets along concealed ductwork through separate units comprising pre-heater, cooler battery and heater battery.

Chilled water piped to the cooler batteries is supplied from two packaged water cooling plants by York Shipley Ltd., each having a refrigeraton capacity of 75 tons. Each plant comprises a 3¾ in. × 3 in. York 16 cylinder compressor direct coupled to a Brook motor, with shell and tube condenser and evaporator, and is automatically controlled to maintain an operating temperature of 68° F. This plant is located in a central plant room on the ground floor. Cooling water for the condenser is circulated by pump through a roof mounted Heenan & Froude forced draught cooling tower.

Heater coils in the air-conditioning units are supplied from a low pressure hot-water system.



The packaged water cooling plant that provides comfort in the studios.

Largest U.S. Industrial Refrigeration Plant

Cools Concrete for Glen Canyon Dam

Glen Canyon Unit, Colorado River Storage Project, Arizona - Utah. Contractor's concrete mixing facilities on west rim of Glen Canyon. At upper left are cement and pozzolan storage silos, at right is cooling tower, then refrigeration plant, on ledge below is batch plant, with transfer car on track below.

CLAIMED to be the largest single industrial refrigeration installation ever assembled in the United States, the plant being operated to cool the concrete placed in the Glen Canyon Dam develops in excess of 4,000 tons of refrigeration with a total connected horsepower of more than 7,000. With this plant it is possible to place concrete round the clock at the specified temperature of not more than 50° F., even when the ambient temperature is as high as 110° F. During the summer of 1960 the ice plant alone produced 50,000 tons of ice, probably more than any other single ice plant in the country.

Forming part of the U.S. Bureau of Reclamation's huge Colorado River water storage scheme, the Glen Canyon Dam project, now under construction and due for completion in 1964, involves the largest contract ever let by the Bureau and what is also claimed to be the biggest competitively-bid contract ever awarded to a single contractor. Valued at $107,955,522 and awarded to Merritt-Chapman and Scott, the contract includes the batching, mixing and pouring of some 5,100,000 cu. yd. of concrete in the dam and power house.

In accordance with the specifications laid down by the Bureau of Reclamation, the temperature of the concrete as placed in the dam must be between 40° and 50° F. Further clauses specify that the heat of hydration during the first 12 days after placing must be dissipated by the circulation of water, no warmer than the temperature of the concrete when placed, through embedded cooling pipes in the dam itself ; and that all concrete in the dam below elevation 3,450 must be lowered to 40° F. as a final step before grouting of the joints is carried out.

Pre-Cooling and Post-Cooling

Thus the concrete must be both pre-cooled and post-cooled. Pre-cooling is necessary to keep the maximum temperature of the concrete, *i.e.* the placing temperature plus the temperature rise after placing, to about 75° F. or less to minimise the danger of the blocks in the dam, some of which are 7½ × 210 × 70 ft. in size, cracking when they are cooled to as low as 40° F. before grouting the contraction joints. Post-cooling controls the temperature rise resulting from the hydration of the cement and later the same pipes are used to cool the concrete in order to open the contraction joints so that they can be grouted.

Post-cooling was comparatively easy to provide for since it was specified that the cooling water must travel through the embedded coils at speeds of at least 2 ft. per second or 4 gallons per minute. To meet the pre-cooling specification was more difficult.

In the summer the normal temperature of the aggregate used in the concrete is about 87° F., while that of the cement is in the region of 150° F. and of the pozzolan 120° F. It was estimated that a normal mix with river water would have a temperature of about 94° F. To reduce this to the required 50° F. maximum a system of four stages of cooling was planned.

The first stage of cooling of the ingredients takes place during the time the aggregates are on their journey on the

conveyor belt running between the stockpile reclaiming tunnel and the batching plant storage bins. This belt is taken through an 8 ft. diameter, 250 ft. long pipe in which aggregate sizes ⅜ in. to 6 in. are cooled to 50° F. by jets of 35° F. water, of which about 2,200 gallons per minute are used. The aggregate subsequently passes through dewatering screens and the water is recycled to the refrigeration plant through a settling pond. This stage alone would be capable of reducing the temperature of the mix to about 72° F.

Aggregate Cooling

In the second cooling stage, the larger than ¾ in. aggregate is air-cooled in the storage bins to 30° F. For this purpose 10 refrigerating coils circulating ammonia are attached to the sides of the batching plant and 14 fans, powered by 10 h.p. motors, force the cool air through the aggregate. During its passage from the bottom to the top of the bins, whence it is recovered for re-use, the air rises in temperature from 30° F. to between 40° and 45° F. In combination, these first two stages would be sufficient alone to bring the temperature of the mix down to about 64° F.

The third step, which, in combination with the other two, would have the effect of reducing the mix temperature to 59° F., is to maintain the mix water at a temperature of 35° F. by continuous re-circulation.

Flake Ice

Finally, flaked ice, made by 22 North Star, 1-ton per hour capacity machines, is used as a substitute for part of the cold water for the mix in proportions varying with the air temperature. A surge tank is used to store enough ice for 60 batches, mechanical rakes drawing the ice toward screw conveyors which deliver to the hoppers used for collecting all the mix ingredients. All four stages of cooling have the effect of reducing the temperature of the mix to about 47° F.

Developing in excess of 4,000 tons of refrigeration and with a capacity equivalent to the making of 6,000 tons of ice per day, the refrigeration plant is housed in two steel buildings with a total floor area of about 18,000 sq. ft. and is located on the edge of the canyon near to the batching plant. Ammonia is used as the cooling medium and the ammonia compressors have a total connected brake horsepower of 6,200. These include four York ammonia compressors and 10 Frick ammonia compressors. Other major pieces of equipment include four Fuller low-stage ammonia boosters and eight Frick condensers.

Ten Frick tube-type chillers are in use at Glen Canyon, three of these being employed in the aggregate cooling section, two on the cold water for the mixes and five, located in the bed of the canyon, for the cold circulating water which is passed through the embedded pipes in the dam. The three largest of these chillers are those used in the aggregate cooling section and these cylindrical tanks are fitted with 859 1¼-in. diameter tubes. The cylinders are filled to within 11 in. from the top with liquid ammonia which has been cooled by a lowering of pressure and the water to be cooled in the chillers makes six passes through the tubes surrounded by the ammonia.

The plant control panel is connected electrically to thermocouples at 17 points on the ammonia pipe lines, nine on the air system and 14 on the water system. Temperatures can immediately be checked by depressing the appropriate push-button.

In the dam, the 1-in. aluminium cooling pipes, tested to 50 lb. p.s.i. pressure, are spaced about 30 in. apart over the entire surface of each block as it is poured and about 4,500,000 ft. of such piping will be required in all. Being made of aluminium, long lengths of pipe can be handled by one man. Below elevation 3,200, the single grids or cooling coils do not exceed 1,800 ft. in length, while above this elevation, the maximum length is 1,200 ft.

The water used for cooling and batching at the Glen Canyon project is obtained from wells sunk near to the aggregate plant, about 5½ miles away at Wahweap Creek. Chromate and sulphuric acid are used to neutralise the alkalinity of the water and thus to avoid the formation of scale in the compressors.

One superintendent and three engineers are responsible for the operation of the Glen Canyon refrigeration plant. Two of the operating engineers are in the main refrigeration plant building while the third attends to the placed concrete cooling equipment in the bed of the canyon.

On September 30 the Hermetic Unit Division's general sales office of **L. Sterne & Co. Ltd.,** was transferred from 2, Caxton Street, Westminster, to: Sternette Works, Kelvin Avenue, Hillington, Glasgow, S.W.2. (Tel. Halfway 3241 : Telex: 77442). The home sales office of the Hermetic Unit Division, also formerly at Caxton Street, is now located at: Sterne House, 36–38, Peckham Road, London, S.E.5. (Tel.: Rodney 6300. Telex: 23269).

* * *

Dewhurst & Partner Ltd. have introduced the type EB 2-pole changeover plug-in relay. Notable for its small size the EB relay has a wide range of applications including control systems where continuous and frequent operation (up to 3,600 per hour) is required. Normally supplied for coil voltages of 24 or 220v. a.c. the relay is also available for voltages in the range 6v. to 110v. operating a.c. or d.c., or, with series resistor, 400v. a.c. or 220v. d.c. The EB relay has an international octal base fitting, but a special plug-in baseplate is available for solderless wiring. Measuring only 2⅜ in. × 1⅞ in. × 1⅜ in. overall and weighing less than 3¼ oz. the relay will operate satisfactorily in any mounting position. Encased in clear plastic it is completely dustproof.

* * *

Following a recent illness, Mr. D. R. Mackie, at his own request, has resigned from his position as managing director of **Monsanto Chemicals Ltd.** with effect from October 1. He continues as a member of the board. Mr. Mackie will be succeeded as managing director by Mr. John C. Garrels, jun., deputy managing director, who has been actively carrying out the duties of managing director since Mr. Mackie's illness in March. Mr. Garrells joined Monsanto Chemicals Ltd. from the plastics division of its American parent company at the beginning of 1961.

* * *

Mr. G. V. Cox has been appointed general manager of sales, plastics products, of **Monsanto Chemicals Ltd.,** and Mr. M. W. Waugh general manager of sales, chemical products. Both general managers will report to the director of sales, Mr. D. C. M. Salt. Mr. Cox, who joined Monsanto in 1951, will be responsible for sales of polyethylene and styrene plastics. Mr. Waugh, who came to the company in 1947, will be responsible for the sales of fine, heavy and technical chemicals.

Design of Chilled Water Mains for Maximum Economy in Air-Conditioning Systems

By H. MERVYN MEACOCK, M.Inst.R., M.R.S.H., A.M.I.I.F.

THE use of chilled water for air-conditioning is increasing and with it the reticulation systems are becoming more extensive. At the same time, there is a wide variation of conditions which are thought to be suitable standards for design of loose systems. One of the first things which the writer did when a rapid expansion commenced was to set up for himself standards which he then used in all layout work for chilled water reticulation systems:

3 gal. per minute per ton was the water quantity.

1 lb per sq. in. per 100 ft. run of pipe was the design figure for pressure drop with an upper limit of 2 lb per sq. in. per 100 ft. for short runs and 0·5 lb per sq. in. as the lower economical limit.

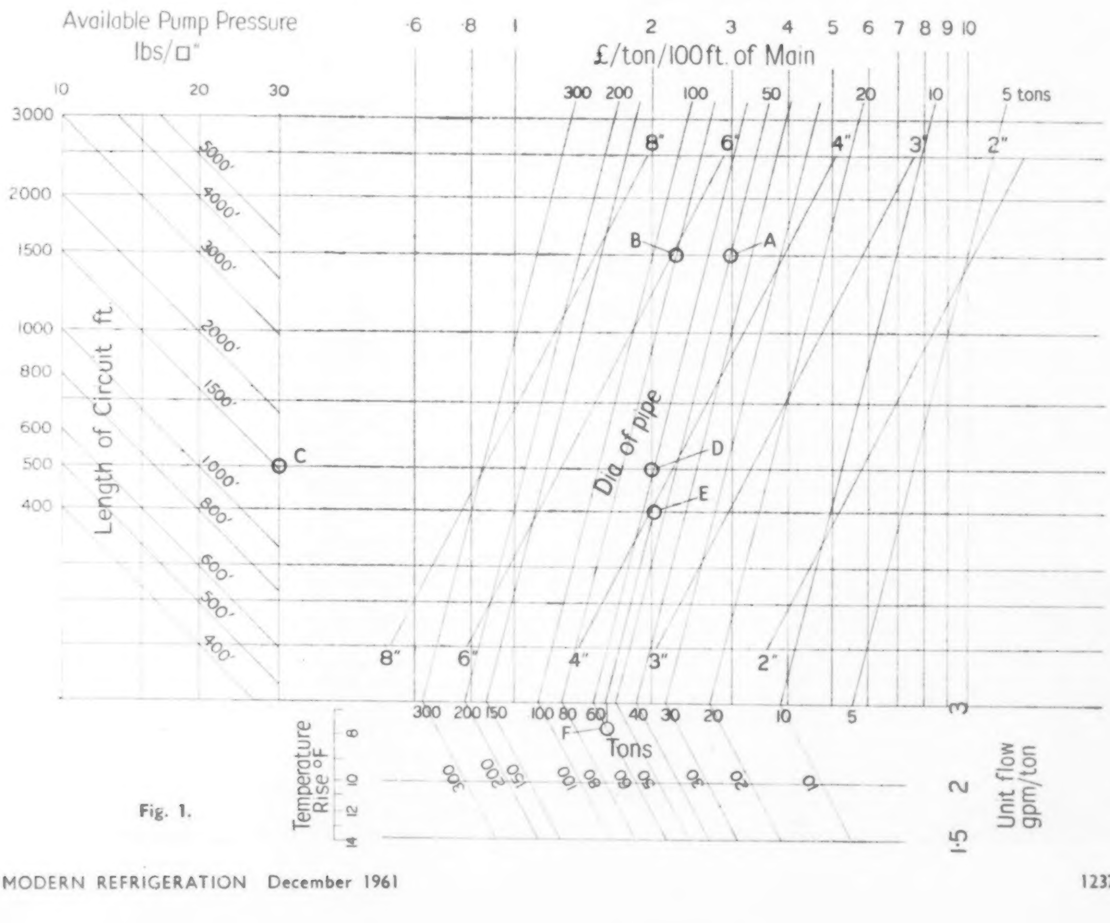


Fig. 1.

The use of these figures for design was very tidy and the results were satisfactory in operation and were used for several years. The basis of design was shown in fig. 5 of an article published in this journal in February this year.

One particular housing estate, however, had had continual additions on this basis and finally contained some six and a half miles of mains built up piecemeal. Some difficulties in distribution occurred and a complete hydraulic survey was necessary. At the same time, the rising costs of pipe and insulation were causing some concern and raised the fundamental question as to whether chilled-water systems where the most suitable for general use.

Cost of the mains relative to the plant and the air handling units showed that economy in mains design was the feature in which savings could be greatest. As a result the method of design was changed and each circuit of a system is now "custom built" for maximum economy. The work entailed in doing this required a good deal of trial and error and was time consuming, so that some quick graphical means of solution were sought. The complete means eventually evolved are here described.

The basic graph is shown in fig. 1. It is very flexible since it only requires the tonnage and the length of circuit to offer a series of solutions from which the most economical can be selected.

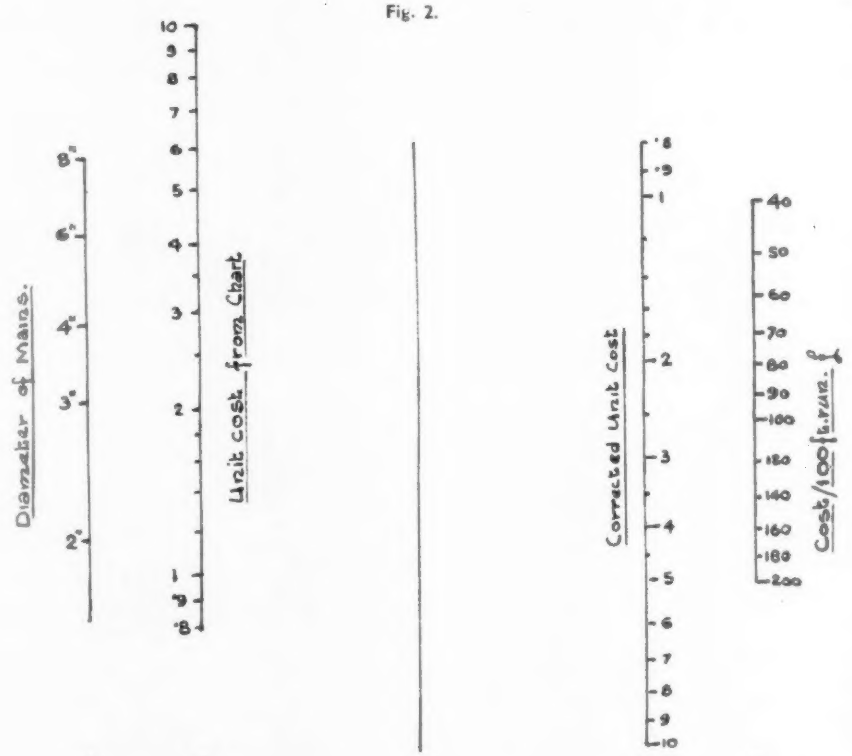
For example, a circuit is loaded with 60 tons and has a total length of 1,500 ft. indicated by A. If this point is accepted a 6 in. main would be installed and would require a pump having an available head of 10 lb per sq. in. The flow would be 3 gal. per minute per ton and the mains would have additional capacity available up to 80 tons (B).

Should it happen that a pump is already available with a free head of 30 lb per sq. in. (C) and no likelihood of increased load exists it would be possible to use a 4 in. main by decreasing the flow rate. Drop vertically from D to E follow the constant tonnage lines to the base (3 g.p.m. per ton) and drop vertically to 60 tons (F).

A 4 in. main can be used with a flow of 2·6 g.p.m. per ton. The cost of the 6 in. main would be £2·7 per ton per 100 ft. of main or £2,430 as against £2·0 per ton per 100 ft. of main or £1,800 for the 4 in. main. The range of cost from £0·8 to £10 per ton per 100 ft. of main shows that great savings are possible by careful attention to design.

Another example of the use of the chart would be :—

Fig. 2.



Correction Chart for Mains Costs

From A to E through XC.

From B through XC to D

H. Mervyn Meacock
October 1961.

A & B are each loads of 100 tons each 1,000 ft. from the plant and separated from one another by a distance y ft. Is it better to run separate flow and return mains to each plant or to combine them both into one triangular circuit ?

Condition 1 · y = 1,000 ft.

(*a*) Load 100 tons, 2,000 ft. run 6 in. pipe at 20 lb per sq. in.
Cost = £1·8 per 100 ft. per ton = £3,600 × 2 = £7,200.

(*b*) Load 200 tons, 3,000 ft. run 8 in. a 30 lb per sq. in.
Cost = £1·25 per 100 ft. per ton = £7,500.

Under condition 1, it is cheaper to put in two circuits initially and there will be a further saving in pumping costs.

Condition 2. y = 500 ft.

(*a*) As condition 1. = £7,200.

(*b*) Load 200 tons. 2,500 ft. run 8 in.
Cost = £1.3 per 100 ft. per ton = £6,500.

Under condition 2, it is cheaper to put in a single circuit for both loads.

Heat Gains

The heat gains per foot run of buried mains have been found to be substantially equal for any size of pipe when using cork or foamed polystyrene insulation in the following thicknesses.

Dia. per pipe Nom. bore	Thickness of Insulation
8	3
6	2½
4	2
3	1½
2	1

The overall mains loss will be roughly constant for any given length of main irrespective of size. The unit loss per ton, however, will obviously drop as the load increases.

Available Pump Pressure

This is the head available for overcoming mains loss after deducting the evaporator pressure drop and the air handling unit pressure drop from the working condition head.

Length of Circuit

The calculations are based on the total length plant room to plant room of a reversed return circuit. In this form of circuit a multiple load has the effect of consecutively reducing the flow main diameter while increasing the return main diameter at a parallel rate. Where the circuit is duplicated only one length is measured. Thus the length of the circuit in fig. 2 would be 4,000 ft. for cost or hydraulic calculations. (2A + B + C + 4D.)

Unit Flow

The unit flow on the chart is related to temperature rise. There is no disadvantage in having a number of circuits with different temperature rise except that each air handling unit requires treating differently to match the flow.

Cost Correction

The cost of mains laid and lagged may vary according to a number of factors. It was stated earlier that for the initial cost estimation one length of main should be taken and this is adequate for comparative purposes in deciding on the layout of the system. Having decided on the system it is desirable to make a detailed check on pipe sizes by cost by length of circuit.

Taking the example of figure 2 again the length of circuit taken initially was made up of (600ft. × 2 ft.) + (500 ft. × 2 ft.) + (100 ft. × 3 ft.) = 2,500 ft. and an assumed run of 6 in. pipe throughout. At £166 per 100 ft. (base figure) this would be £4,150. In making out the final estimates when this layout has been agreed the actual runs would be :—

In.	Ft.	Ft.	Ft.				£
6 pipe	600 +	500 +	400	=	1,500 at 166	=	2,490
4 pipe	800 at 113			=			904
3 pipe	400 +	400		=	800 at 82	=	656
							£4,050

or £131 per 100 ft. average. Thus the corrected value (original estimate £2·1 per ton per 100 ft. run) would be £1·7 when computed as follows from fig. 2.

166 on A to 131 on E pivot on C at X

2·1 on B through X to read result on D (1·7)

The corrected result does not, it will be seen, materially alter the outlay but allows for a more accurate cost comparison in making an analysis of a composite system.

REFRIGERATED AUTOMATIC KIOSK

INSTALLED in the self-service buffet on Waterloo Station opposite platforms 13 and 14 by the British Automatic Co. Ltd., Britain's first Continental type "auto-kiosk" is the first of its kind, selling commodities ranging from cigarette papers, matches, popular brands of cigarettes, cut tobacco and sweets to 1 lb. boxes of chocolates.

This most striking bank of machines ranges the full length of the wall just inside the entrance door to the buffet. The machines are framed in black and concealed lighting illuminates the canopy, flowers and machines.

The machines were supplied and assembled by the British Automatic Company and is the first bank of its kind, as an "all-in-one" unit for cigarettes, tobacco and confectionery, which they have installed in this country.

The assembling of the machines brought problems for B.A.C. There is a great deal of heat given off from the buffet and the lighting above the machines, so cooled air has to be passed through the compartments of the machines selling sweets and chocolate. To obviate the chance of the chocolate melting from the heat, B.A.C. have installed a ¾ h.p. water cooled Kelvinator unit which has a high pressure water valve fitted with high and low pressure gauges.

Holes have been punched in the backs of the machines and cold air is blown in, via tubes, at the bottom of each machine through the holes. The cold air passes to the top of each machine and is then sucked out. The air is passed over cooling coils and the process repeated.

Expanded polystyrene container for carrying frozen foods.

MANN EGERTON'S THREE DAY SHOW

New Vehicle Body could slice running costs

WITH one exhibit which, if all tests are satisfactorily passed, is likely to revolutionize insulated and refrigerated vehicle construction, and with a number of others showing development or modernization, the three day show put on by Mann Egerton and Co. Ltd., of Norwich last month for the Press and potential customers, created considerable interest.

Although built to conventional dimensions on a 30 cwt. Ford Trader chassis, the vehicle prototype which was available for inspection had a claimed weight saving of five cwt. on a conventional transporter of similar size. The secret is in the use of Plasticell, a closed cell expanded polyvinyl chloride manufactured by Microcell, Ltd., a subsidiary of B.T.R. Industries, Ltd. Mann Egerton have developed a " sandwich " panel using Plasticell as a core, skinning the compound with 20g aluminium bonded with a bitumastic resin adhesive, the joints in the insulating material being joined to form a complete body mould. Timber framing is used only at the rear doorway and the rear door.

At present metal or timber vehicle bodies are made up of rings and connected by longitudinal members. A standard insulating material is then used for filling up the framework cavities.

Refrigeration equipment of forced convection type is mounted on a cradle on the offside of the body. It is petrol powered in transit.

Whilst the normal vehicle body framework is dispensed with, the high strength to weight ratio is such, it was pointed out, that resistance to crash damage is high when using the expanded material. The D.40 grade of Plasticell is said to have a compression strength of 40 p.s.i., a density of 2·5 lb. per c.ft. and a " K " value of approximately 0·2 B.t.u. per in. per hour per sq. ft. per F. Vapour permeability is claimed to be as low as 0·0026 grains per sq. ft. per 1 in. thickness per millibar.

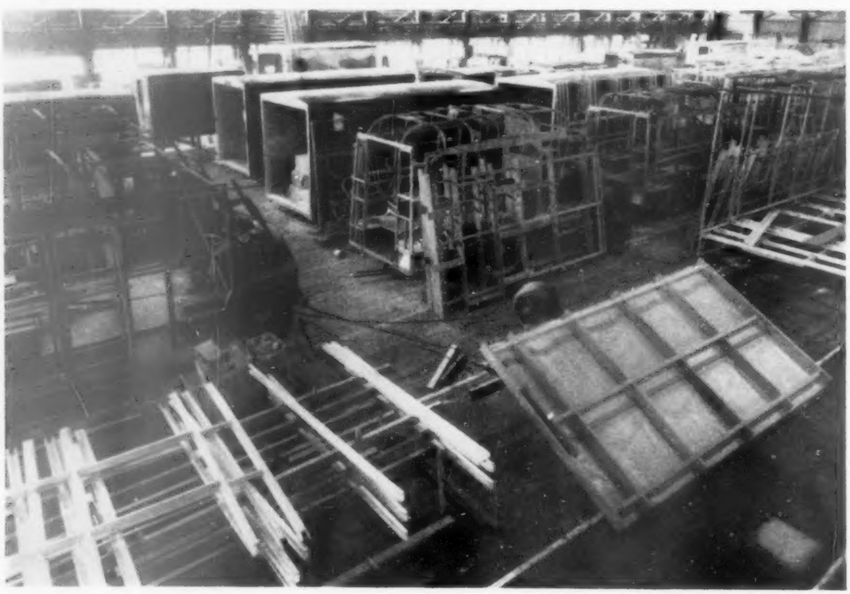
Plasticell is not new. Similar material has been used for several years in France on refrigerated vehicles, and as a flooring not susceptible to high heels it has proved valuable in aircraft. This however, is claimed to be the first application of the process to insulated vehicles in this country.

Considerable savings in construction time and labour costs, it is thought, will offset the relatively high cost of the material, and the saving in the overall weight of the vehicle will, of course, facilitate lower running costs, or an increased payload, which, in the long run, amounts to the same thing.

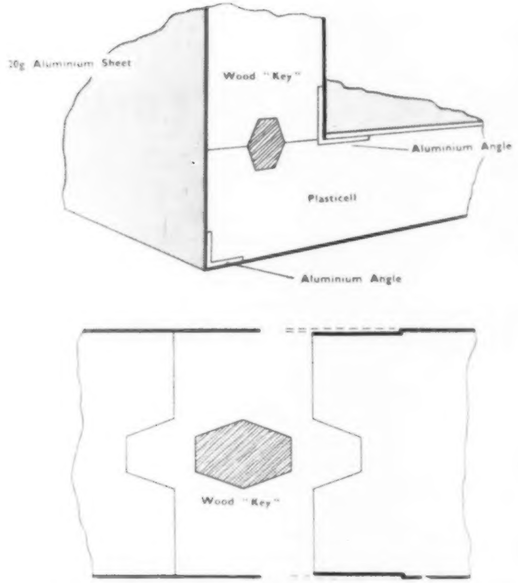
One of the tests to which Mann Egerton's prototype will be subjected is a tropical test chamber which has been in use now for some six months. The company's exports to hot countries, notably Africa, are increasing, and the chamber enables stringent tests to be carried out on low temperature vehicles.

Radiant heaters create ambient temperatures up to 145° F. with an artificial sun temperature of 175 F., and they are adjustable in height and lengthwise along the chamber to meet the requirements of the vehicle under test.

Conditions of humidity up to 90 per cent. were available



General view showing part of main coachbuilding shop.



The sandwich panel incorporating "Plasticell."

via the usual humidistats, and thermostats control the temperature, but these can be by-passed when necessary by an over-riding switch in the adjacent instrument room. From here a Honeywell Brown Universal Strip chart recorder enables temperatures to be recorded at 20 points within the vehicle simultaneously every 12 seconds.

Hire of the chamber is allowed at a charge of £10 a day per 24 hours which includes the use of all instruments, although provision of skilled technical or manual labour would be additional.

Designed to maintain a temperature of approximately 5° F. in an ambient of 110° F., and with provision for a short refrigeration hold-over in case of breakdown, a Land-Rover portable refrigerated container attracted attention. Built to meet a demand for such a vehicle on the oil-fields and where remote forward bases require supplies from a central headquarters, this small capacity (46 c.ft.) transporter is a new departure developed in conjunction with the Rover Company, Ltd.

The container is off-loaded at destination, complete with foodstuffs or supplies, and assuming an existing electrical supply, it becomes a static cold room. By using a second container, the Land Rover can run a shuttle service with cold stored goods, leaving one container and picking up the other.

Insulation consists of expanded polystyrene, 5 in. thick on the floor, and 6 in. thick on other internal surfaces, panelled inside and out with 18 gauge aluminium. The refrigeration compressor is driven by a D.C. motor which receives its supply from a generator operated by the vehicle engine when in transit, thus eliminating the noise of an independent engine.

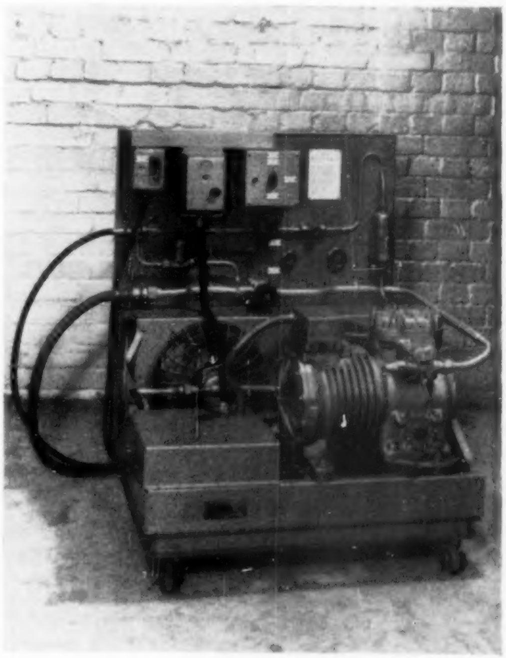
A fascinating demonstration of the spraying of Celspray polyurethane foam showed the practicality of this process as opposed to the slower method of fastening. Mann Egerton and the Baxenden Chemical Co., Ltd., recently conducted experiments in the use of this foam, which is said to have good insulation efficiency and high structural strength in relation to its low viscosity.

As it is a two component polyester-based resin, the components are held in two pressure feed tanks and sprayed simultaneously through a gun so that agglomeration begins to take place as soon as the mixture reaches the surface. Time and labour savings claimed were considerable.

Remote refrigeration, not in itself a new process, has undergone improvement by the company. Where previously flexible couplings used could not be relied on to be 100 per cent. effective a method had been developed to obviate the fault. Air and moisture could before be drawn into the system if the low side of the coupling proved faulty, but in the system patented it is impossible to break the flexible couplings with negative pressure or vacuum in the suction line.

The Distillers Company Ltd., demonstrated their DisChil technique, employing liquid carbon dioxide, injected through a special vent into the closed container to bring down internal temperature to a level where the vehicle's own refrigeration can maintain the required level.

All told, some 100 customers from all parts of the country were invited to see the exhibition and demonstrations, said Mr. R. A. Edmonds, director in charge of manufacturing divisions, at lunch. Production of vehicles was on a large scale, with up to two vehicles expected to leave the five assembly lines daily during the next 12 months.



The remote refrigeration layout incorporating the patented pressure system, as used by Mann Egerton's.

At a board meeting held on November 28th, Sir William Garrett retired after 26 years as a director of Monsanto Chemicals Limited and Mr. J. M. Kershaw was appointed to the board. Sir William Garrett, who first joined Monsanto in 1917 and was appointed a director in 1935, retires from the board at his own request in order to devote more time to his other interests.

1·3 MILLION CUBIC FEET

VAST NEW COLD STORE IN LONDON

ON "FREON"

NORTHERN Cold Storage Ltd., this month put into operation the first chambers of the new cold store which they are building at Stratford, east London.

Having leased a remarkably flat site of 12 acres from British Railways, construction began less than a year ago at High Meads marshalling yard.

Of 10,000 tons nominal capacity when finished at the turn of the year, the building will be extended into two further stages at later dates. In short, the premises now erected represent only one-third of the programmed development.

Conveniently situated only four miles from Thames dockside, close to the North Circular Road, the Blackwall Tunnel and the road artery A-11, this new low temperature centre will serve as a distribution depot for various clients as well as a normal cold store.

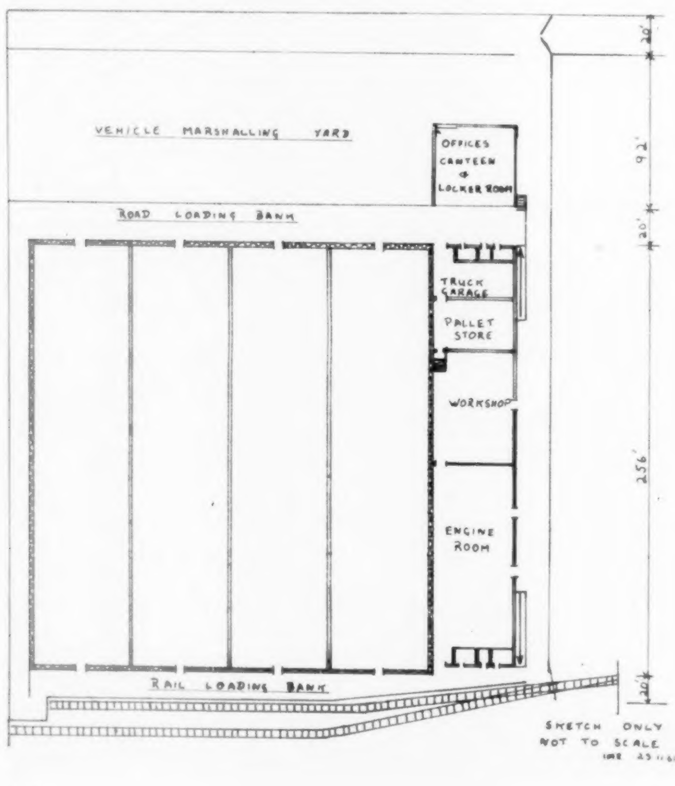
The present building comprises four chambers of 2,500 tons each and of a maximum stacking height of 22½-ft., allowing full use of mechanical stowing aids.

Many exceptional features will be found in this new building. The inner walls have all been prefabricated, on the site, and are insulated with glass wool, while slab cork is laid on the floors which are finished in granolithic. Air circulation in these chambers will be low in speed for very close attention is being paid to the care of the goods in store. Research already undertaken by this company shows that, with meat for example, loss in weight can be held to an absolute minimum by severe control of air speed and humidity.

Refrigeration machinery will operate on "Freon" which is a departure in Britain for chambers of this size. It is anticipated that the four rooms will be held at the following temperature levels : (1) –20° F. ; (2) 14° to 16° F. for butter ; (3) 14° F. for meat ; (4) Various temperatures to suit traffic to come in the future.

Those readers who have seen the several cold stores of the Helsingborgs group—in Halsingborg, Stockholm, and Grimsby will know that the company devotes a great deal of space at these premises to accommodating large road vehicles. At Stratford, the marshalling area is 90-ft. deep while the covered loading bank extends the whole length of the building.

The railway track adjoins the other end of the block. to facilitate the rapid handling of goods by road or rail, on the north side of the store is a vehicle marshalling yard 2,310 square yards in area, serving a loading bank capable of taking 22 road vehicles simultaneously ;



Sketch plan of the new premises of Northern Cold Storage Company Ltd. in East London.

Helsingborgs' method of pallet stacking whole pig carcases and sides of bacon.

while on the south side two private rail sidings serve a loading bank 300 ft. in length. The store itself comprises four chambers each 58 ft. wide by 254 ft. long measured internally. Free height under the air duct is 22 ft. 6 in., enabling four pallet loads each 5 ft. 6 in. high to be stacked vertically, thus taking full advantage of the available fork lift truck equipment. The total storage capacity is therefore in the region of 1,300,000 c.ft. Preliminary technical details are as follows :

The refrigeration plant is designed to maintain a temperature of minus 20° F. throughout, but separate controls make it possible to maintain a different temperature in each chamber. Cooling is by means of low velocity air circulation and the ducting system is specially designed to distribute the air evenly over the products. There are two air cooling units per chamber each having a large cooling surface and being fitted with low h.p. fans.

Construction and Insulation.—Walls and roof are constructed entirely of pre-cast concrete elements insulated with 10 in. of glass fibre. The floors are insulated with 6 in. of slab cork.

Floor Heating.—Protection against frost-heave is provided by a series of heating pipes laid in the sub-floor and through which glycol is circulated. A heat exchanger in the engine room enables the glycol to be warmed by waste heat from the compressors.

Compressors.—The two high stage compressors are of the STAL 9-cylinder VW type supplied by the De Laval Ljungstrom, while the low stage compressors are the Fuller rotary type of U.S. manufacture.

Controls.—Apart from the manual starting of the compressors, the plant is designed to be virtually automatic in operation. The temperature in each chamber is automatically controlled and the refrigeration capacity of the compressors is varied automatically to match the load conditions. A very complete range of instrumentation enables a close watch to be kept from the engine room on the performance of the plant. Emergency cut-outs are provided in the various circuits to give "Fail Safe" protection and a control panel simplifies fault tracing.

Defrosting.—The defrosting system is again unique for a plant of this size. Automatic indication is given when defrosting of an evaporator is necessary and the defrosting cycle is initiated by means of a push button. The operation is then completely automatic including the change-over to normal running.

Condensers.—The condensers are of the shell and tube type, working in conjunction with Munters-type cooling towers mounted on the roof of the engine room.

Refrigeration Standards.—The plant is equipped with full stand-by capacity. The equipment and design is in accordance with Lloyds requirements to their + RMC standard.

Evaporators.—The evaporators work on the flooded system, the refrigerant being air circulated by hermetic centrifugal pumps.

The manufacture, types and applications of Permbrite welded stainless steel tubes, together with some cogent reasons for their use, form the subject of a 12-page illustrated booklet just published by **Rollo-Hardy & Co. Ltd.**, a member of the Compoflex Group of companies. The most important points made in the booklet are that Permbrite tube is at least as strong as solid drawn or "seamless" tube and, in addition, is cheaper and more readily available. The methods described of testing the welded tube, undertaken on every batch, prove conclusively that the weld is as strong as the rest of the tube wall. As well as lists of applications, including examples from such firms as I.C.I. and ranging from heat exchanger tubes to bus seat frames, the booklet gives details of the four types of stainless steel used in the manufacture of Permbrite tube. Tables of the alloy composition, together with maximum pressures and weights per foot for a range of outside diameters and wall thicknesses are also given.

The Institute of Refrigeration Bulletin

Institute Headquarters: New Bridge Street House, New Bridge St., London, E.C.4 (CENtral 4694).

JANUARY MEETING

AT the meeting of the Institute to be held on Thursday, January 4, 1962, at 5.30 p.m. at the Institute of Marine Engineers, The Memorial Building, 76 Mark Lane, London, E.C.3., Mr. S. I. Neuman, associate member, will present a paper entitled "Refrigeration in Dam Cooling."

The paper traces the causes which necessitate the use of refrigeration in modern concrete dam construction to the time factor and evaluates the technical and economical advantages and disadvantages of various methods currently in use.

The author then deals with the mathematical background upon which the cooling of concrete by means of embedded pipes is based. He then describes the methods by which the latest thinking was applied to the construction of the Kariba Dam spanning the Zambezi river. It was not possible to use the curves giving concrete temperature reduction and water temperature rise developed for other dams as published figures all related to lift of 5 ft. In the case of Kariba lifts were, however, 7 ft. 6 in. Modified curves have been therefore developed, one of which is reproduced in this paper.

Problems related to piping and refrigeration plant are also discussed.

INFORMAL RECEPTION AT THE NATIONAL COLLEGE

An informal reception for members and their ladies has been arranged for Wednesday, January 3, 1962, at 4.30 p.m. in the new building of the National College for Heating Ventilating, Refrigeration and Fan Engineering, Southwark Bridge Road, London, S.E.1.

Details of this function have already been issued to all members and applications to attend should be submitted as soon as possible on the form attached to the secretary's letter of November 23.

MEMBERSHIP

At the meeting of members held on May 4, 1961, the following were elected to membership of the Institute :—

ASSOCIATE MEMBERS

Cooper, Alan John, 57 Clarendon Gardens, Stone, Dartford, Kent.

Everington, David William, 52, Lovelace Drive, Pyrford Woods, Woking, Surrey.

Lowe, Arthur, 33 Darley Avenue, West Didsbury, Manchester, 20.

Meadows, Victor Sidney, "Croylands," Yarmouth Road, North Walsham, Norfolk

Miller, Allan Sinclair, Jennadin, Ridge Hill, Hereford.

*Seppings, Alwyn Henry, Parc De Franconville, Apartment 538, 61 Avenue De Paris, Franconville (Seine-et-Oise), France.

Smith, Vincent John Edwin, 63 Efflinch Lane, Barton-u-Needwood, Nr. Burton-on-Trent, Staffs.

†Stanley, Michael Charles, c/o Hay's Wharf Ltd., Tooley Street, London, S.E.1.

Syminton, Barry Wilson, P.O. Box 1783, Wellington, New Zealand.

Walker, Jack Alfred, 45, Kenilworth Drive, Borehamwood, Herts.

* Transfer from Associate.

† Transfer from Graduate.

ASSOCIATES

Amso, Abdul Masieh, c/o Basrah Petroleum Co. Ltd., Basrah, Iraq.

Guggiari, Frederick Robert, Building A.14.4., U.K.A.E.A., Aldermaston, Berks.

Guy, Reginald John Horace, 64 Brookside Road, Hayes, Middlesex.

Miller, William, 21 The Netherlands, Coulsdon, Surrey.

Newsome, George, 49 Cheltenham Place, Halifax. Yorkshire.

GRADUATES

Braham, George Derrick, 39 Yarborough Road, Grimsby, Lincs.

Kapoor, Juldip Raj, 65 Inverness Terrace, London, W.2.

Katyal, Jagdish Chand, 8 Ravenscroft Avenue, London, N.W.11.

Larsen, Gordon Alan, 18 Woodbine Road, Sidcup, Kent.

Minassian, Viggen Hrant, 26 Hartswood Road, London, W.12.

Mukherjee, Amiya Bhusan, 15 Offerton Road, London, S.W.4.

Mukhopadhyay, Arun Kumar, 10 Lysias Road, London, S.W.12.

Nandi, Ananda Kumar, 2 Glenloch Road, London, N.W.3.

Padwal, Suresh Ganpat, 77 Plum Lane, Plumstead, London, S.E.18.

Saharya, Mehesh Bahadur, 109 Priory Road, London, N.W.6.

Shanbhag, Madhav Sheshagiri, 83D Lexham Gardens, London, W.8.

Tapsell, Philip, 86 Kingsland High Street, London, E.8.

Teixeira, Antonio Miguel, 29 Kensington Square Gardens, London, W.2.

Trembath, David Alfred, 93 Sandy Lane, Cheam, Surrey.

Vatts, Virendar Kailash, 65 Inverness Terrace, London, W.2.

LECTURES ON HEAT TRANSFER

A post-graduate course of 10 lectures as an introduction to "The Mathematical Theory of Heat Transfer" will be given on Tuesday evenings at 6.30 p.m., commencing on January 16, 1962, at the National College for Heating, Ventilating, Refrigeration and Fan Engineering.

The lectures will be given in the Lecture Theatre of the National College, Southwark Bridge Road, London, S.E.1, by Mr. E. Woodcock, M.SC. The programme is as follows :—

1st Lecture—January 16, 1962. A review of the science and practice of heat transfer.

2nd Lecture—January 23, 1962. Some important basic results of wide practical significance found with the

aid of relatively simple mathematical techniques.

3rd Lecture—January 30, 1962. A brief review of mathematical methods and functions useful for heat transfer analysis.

4th Lecture—February 6, 1962. Transient heat conduction.

5th Lecture—February, 13 1962. Heat transfer by natural convection.

6th Lecture—February 20, 1962. Heat transfer by forced convection with laminar boundary layers. Part I.

7th Lecture—February 27, 1962. Heat transfer by forced convection with laminar boundary layers. Part II.

8th Lecture—March 6, 1962. Heat transfer by forced convection with turbulent boundary layers.

9th Lecture—March 13, 1962. Miscellaneous topics including radiation, condensation, evaporation and simultaneous heat and mass transfer.

10th Lecture—March 20, 1962. Numerical methods and analogues, especially for transient heat conduction.

Possession of a degree in mathematics, physics or engineering is essential for admission to the course. The fee for the course is £1.

Further details, together with a form of application for admission to the course, may be obtained from The Clerk to the Governers, National College for Heating, Ventilating, Refrigeration and Fan Engineering, Borough Polytechnic, Borough Road, London, S.E.1.

The Presidential Address

By C. M. BRAIN, ESQ., M.I.Mech.E., Member

(continued from November issue)

DEALING with the recommendations of the Carr Committee, the president declared :—

One of its chief pleas is for a review of the period and content of the apprenticeship, and draws attention to the apparent magic figure of five years which is demanded for apprenticeship for so many differing occupations and suggests that, either the period of five years could be shortened in some cases, or the training content enlarged. The report also urges closer co-operation between industry and those responsible for further education. The importance of the transition period between school life and life in a works is stressed and I propose to deal with this at a later stage.

The second committee of interest to which I referred is the Crowther Committee, whose voluminous report in two volumes totalling nearly 800 pages was published in 1959. This report, encyclopaedic both in dimensions and content, is extremely readable and it would be presumptuous, and also attempting the impossible, to try to summarise its contents here. I would like, however, to make two points. The first is that it gives the case for compulsorily extending the school-leaving age to 16 somewhere between 1966 and 1968 and that there should be part-time compulsory attendance at colleges for further education up to the age of 18 by 1970 ; in other words, that the suspended provision of the 1944 Education Act should be put into force by these dates. For my second point, I would like to quote the following from the report :

> " We cannot help but be disturbed by the mediocre standards of spoken and written English among children leaving our schools and by the low standards in the field of mathematics which are (so it seems to us) wrongly accepted as inevitable for far too many pupils."

A scathing conclusion, I feel, but only too true.

I would like to recommend these two volumes to any who are interested in the training and education of that very large strata of our society who receive their education in the state modern schools. It would seem to me that it is to this strata we shall have to look in the future, as in the past, for a very large proportion of our technicians and technologists. I must not close this review of what the Government has done or is doing without brief reference to the White Paper issued early this year entitled " Better opportunities for technical education." Again we have the admission that the present system has not kept peace with the changing face of industry, particularly the need for more and better trained technicians.

The proposed changes which are described as a " major reconstruction " are aimed at broadening the education and adapting it to meet more closely the needs of industry, and what is more important still, substantially to reduce the present high rate of wastage of students who do not complete their course, or who fail to pass the examinations at the end of the course.

If I may just revert to the Crowther Report, we find these figures for the percentage of students satisfactorily completing the years for national certificates :—

S1.	S2	S3 O.N.C.	A1	A2 H.N.C.	
68	44	26	14	10	a wastage of 90%

The proposals of this White Paper aim rather at the rearrangement of courses than at changing their content and emphasise the importance of the selection of students for suitable courses whether for craftsmen, operatives, technicians or technologists.

I hope I have not spent too much time in tracing the action, or lack of it, of our Government since the passing of the 1944 Education Act, but I felt that the matter was of some interest in that it indicates the standard at which the Government aims in providing the basic technical training. Our problem will be to superimpose on that the specialised training which we consider essential to enable the student to take his place in the refrigerating industry of the future.

I mentioned earlier the difficulties of recruitment due to the lack of glamour connected with our small but specialised industry. I cannot help thinking that, if only we could publicize some of our more interesting problems and achievements, they would be found to be every whit as fascinating as those found in some of the more glamorous and better known industries. It is the fact that we have an infinite variety of problems to tackle that makes the life of the refrigerating engineer one that is both satisfying and rewarding, although on occasions it can be humbling.

You may perhaps feel that my thoughts are travelling too much in the direction of the technician and technologist.

I think at this stage it will be found a very rewarding exercise to consider the education and training of the hewers of wood and drawers of water. We have heard a great deal in recent years about the " bulge "—the ever increasing number of school leavers coming into industry at about this time, due to a spectacular increase in the birth rate just after the conclusion of the last war. The facts are these. The number of school leavers in Great Britain at 15½ years of age leaving during 1962 will be 52 per cent. greater than in 1956. In 1963 the figure will drop to 34 per cent. and in the following seven years will steady out at 20 to 25 per cent. above the 1956 figures.

Figures for those leaving later than 15½ show an even greater increase, those leaving at over 16 increasing to over 100 per cent. above the 1956 figures.

It is quite certain that in the past a great number, probably a considerable majority, of those who held the highest positions in industry have come from those whose basic education finished at the age of 15 or 16. It is appreciated that this must change in the future due to the

increasing complexity of industry. It is certain, however, that vast numbers of those who leave school at this age must inevitably include many who, although they leaked through the sieve at 11 plus and on later occasions, would with suitable training and further education prove of outstanding ability and be capable of filling some of the top positions in industry to-day.

The absorption of this bulge is a major national problem which can be turned to the national good if rightly handled. Repeated requests by the Government that more places be found in industry, have apparently not been unheeded as can be seen from the unemployment figures for this age group which were published as recently as last month and show no increase.

We as an industry can play our part in this national problem and can at the same time reap considerable benefits therefrom.

By taking a close interest in the education of an apprentice both at the technical colleges and in the works from the age of 16 we should be able to produce, by the time the apprenticeship is completed, a well-trained mechanical engineer with a solid foundation upon which can be put the specialised knowledge which we require. By accepting as large a number as possible of selected youths for apprenticeship, it is quite certain that some will be found of outstanding all-round merit suitable for further specialised training, to enable them to take their part in the particular section of the industry for which their aptitudes best fit them.

In the training of this type of youth it is essential, if one is to hope for success, to start off with the right material and to ensure that the change from school to factory life is not a sudden drastic one which is likely to produce an unpredictable psychological change of outlook, but a gradual and controlled one, aimed at maintaining the spirit of esprit de corps inculcated at school and the desire to continue to learn ; albeit, the learning may be something quite different from that he has experienced at school. A great deal can be done by means of contacts with local schools and youth employment officers to emphasize the fact that your company is only interested in the type of boy who is keen and able and that you will offer a sound practical and theoretical training to fit him for a career in any branch of mechanical engineering, always with the thoughts in the background that it is a privilege to be trained by your company.

The fact that worth-while careers in refrigeration can be found in your company can be an added advantage.

Manifestly the first essential is the correct selection, and here a great deal depends upon the interview you have with the boys. Much has been written upon the technique of the interview, so I will not go into this except to say that the opportunity should be used not only to get to know the candidate, but also to let him learn about you and your company, and the prospects he will have if he accepts your offer of apprenticeship. School reports are a useful source of information and can be studied at the interview. It will be found useful also to hold your own entrance examination. This can usually be organized for you by the local technical college. The cost involved is small but it can form a basis for your initial selection. Many who will be found not to have mastered " the three Rs " up to the standard you might expect of them can be eliminated and save a great deal of time in the later processes of selection.

It is significant of the times that, not only does the interview enable you to judge the candidate, but also the candidate takes the opportunity to judge his prospective employer, to compare him with others he has met, and sometimes to choose the other employer.

The first weeks that an apprentice spends in your works can have a far reaching effect upon his subsequent career. The more that the upheaval caused by the change from school to factory life can be smoothed out, the more successful his training period is likely to be. This change can be aggravated when a leaver at 15½ years of age has to wait until he is 16 before his apprenticeship commences. In this case he may be employed as an office messenger or a shop boy, in either case he may not be fully employed and an absence of discipline and a full programme of activities such as he has had at school will have an unsettling effect and produce a feeling of neglect, a bad preparation for the time when his training is to commence.

I believe that time spent on the youth at this stage will be very well repaid and I propose to give some details of the way I have attempted to tackle this.

For the first three weeks after the arrival of a new batch of youths they are brought together for one hour daily, usually for the last hour in the day. This involves the provision of an apprentices' lecture room, a necessity for any organized scheme of training, and when not in use by the apprentices will be found much in demand by a variety of other groups, works conferences etc. Its furnishings must inevitably be reminiscent of the class room, but a little ingenuity can make it attractive, although mainly functional.

For the first two or three days talks will be given on such subjects as the objects of apprenticeship and the obligations of an apprentice, the history of the company and its traditions and an outline of its products, also its ramifications both at home and abroad. Thereafter, the party can be taken each day to one particular department or shop and handed over to the foreman, who will organize a tour of the shop and point out its important features. The hour can be spent half in the shop and half in the lecture room, where the foreman can explain in a quieter atmosphere the functions of his department and what will be expected of the apprentices who are later to go into it. After all shops and perhaps the drawing office have been visited, a talk by the works doctor on matters of hygiene and general health and especially safety precautions may be given, also where possible an hour with the industrial chaplain who will give advice on the moral and social obligations which arise from the change from school to factory life. Finally one or two sessions can be usefully spent on a questions and answers programme dealing with the content of the course.

By this time, the apprentice should begin to know his way around and to feel his feet, in fact to feel that he belongs and not that he has been suddenly ejected from the sheltered atmosphere of the school into the maelstrom of factory life.

For the effort expended during this transition period to be of permanent value, it is essential that the spirit of belonging, which it is hoped has been engendered, should be made to continue during the whole of the apprenticeship period.

Certain effort will have to be expended by the company in order to maintain this personal contact, always having in view that the practical and theoretical engineering training that the apprentice is receiving is only part of his education, and he must be made to realize that there are other things in life besides just the " Science and Practice of —— " and I would like to suggest one scheme of which I have had experience which I believe contains the germs of ideas which could be developed and improved.

It is obviously not possible to continue with the get-together on a daily basis. These will inevitably become less frequent as the period of apprenticeship progresses. In the case I have dealt with, the programme involved :—

In the 1st year—a monthly talk.
2nd year—a bi-monthly talk.
3rd year—a four-monthly talk.

5th year—week-end and other meetings or study courses and one visit.

5th year—two or more talks. One or more visits.

In the first year the subjects were chosen with the intention of broadening the outlook and encouraging a desire to know something about what is going on in the world outside their particular orbit. I would like to list some of the subjects dealt with as :—

1. The History of Engineering.
2. The Development of British Industry.
3. Production and the Standard of Living.
4. Britain's Economic Position.
5. Wealth or Money.
6. History of Trade Unionism.
7. Why be an Apprentice ?
8. Study, is it worth it ?
9. Team Spirit.

Interspersed during the year were two lectures dealing with the organization of the company. There are many more subjects which suggest themselves, but, as will be the case in later years, the amount of time the apprentice can spend away from his shop must, of necessity, be limited.

For the second year suggested subjects are :—

1. The Function of Production.
2. Wages and Profits.
3. The Function of The Stock Exchange.
4. Self Expression.
5. One further lecture dealing with organization of your Works.

At this stage it is thought desirable to introduce the subject of refrigeration. The apprentice will normally be getting to know somthing about heat engines at his technical college, but will probably seldom hear any mention of the word refrigeration. This one hour's talk has two aims ; one, to indicate the application of his heat engine studies to refrigeration, and the other to enable him to appreciate the significance of the various component parts of a refrigerating plant on which he may be working. Without such explanation he can have little or no idea of the function of these parts.

During the third year, when the apprentice is approaching " Ordinary National " level, the subject of two of the lectures could be " Mechanization and employment," and " Foreign competition," with two rather more advanced talks on refrigeration. These latter can, however, only be in the form of an introduction to the subject and could deal with two general applications, for instance, land installations and marine installations.

For the fourth year, when the apprentice is beginning to show his capabilities, a rather different procedure is adopted. There are a number of week-end and mid-week study courses arranged by various bodies for apprentices. Although it is unlikely that any but quite small firms could send all their apprentices to such courses, by careful selection those who are most likely to benefit can be sent to them. Here they meet apprentices from other companies dealing with widely differing products, and many leaders of industry give their time to attend and give the apprentices the benefit of their experience. This is also usually a suitable age to send apprentices to one of the Outward Bound Schools, which I believe are now so well known that I need not comment on them, beyond giving it as my opinion that, provided the right type of youth is chosen, untold benefit can result.

Also during this year it should be arranged that every apprentice pays one or more visits to a completed installation.

By the time the apprentice is in his fifth year he will almost certainly be spending part or all of his time in the drawing office, and, if the scheme of training has been successful, he will be thinking for himself and will want to continue the study of some of the subjects to which he has been introduced in the talks over the foregoing 4 years.

The two talks suggested for the fifth year could be one from a senior official of the company, on the company's ramifications with a view to interesting the apprentice in a career in your company, either in this country or overseas, and one final lecture which could be in the form of a discussion of the lectures held in the earlier years. This will encourage self expression and the correct use of his mother tongue. A demand from the apprentice that the lectures be continued, but not in the company's time, will be some criterion of the success of the course. Another visit to a completed installation should take place during the year. I would like to digress slightly at this point to include one item, which although it comes under the general head of training, does not form part of the five year plan I have described. I refer to series of lectures given by the most senior technical people available, dealing with the principles of refrigeration and the applications met with in the company. These lectures reach the highest technical level and act as refreshers for members of the technical staff. Some of the more senior apprentices can be invited to these, provided they have time available from their studies.

In my experience, the scheme which I have outlined indicates the maximum that it is practicable to arrange. If it were possible to add to it, I would enter a strong plea for the inclusion of at least an introduction of some liberal studies. It is the wish and I believe the intention of the Government to include facilities for liberal studies at the technical colleges in the future. I think that if these could include an appreciation of the arts in its many forms—painting, architecture, music, drama and literature—and if the apprentice became sufficiently interested to continue these studies, then the result must be an enriched life and one in which the utmost satisfaction will be obtained from doing a job for which one has been well prepared, and more particularly to which one can bring to bear a great deal of knowledge and experience other than that which is purely technical.

The usual apprentices' indenture document is a tripartite one, between company, apprentice and parent. I believe that the co-operation of the parent, especially in the early years of apprenticeship, is particularly valuable and a parents' day arranged during the apprentices' first year provides an opportunity for the parent to see the works and the people by whom their son is being trained. This need involve not more than half a day a year, it can quite well be a Saturday morning. My experience has been that the occasion on which the three parties to the contract meet is invariably one which brings satisfaction all round and engenders a spirit of co-operation, which endures throughout the apprenticeship.

I have purposely omitted here any reference to the actual practical training programme in the works, except that I would make a plea for a period of at least the first six months to be spent in a purely instructional department where the use and care both of hand and machine tools is taught by a qualified instructor. Beyond this the details of training must vary so much depending on the size of the company and the details of their product.

At the age of 21 an apprentice with his higher national certificate in mechanical engineering and with the extra training which I have described should be ready to start his specialized studies in refrigeration. It is, I think, most important that any serious specialized study of refrigeration should not be undertaken before this time. The student will have been fully occupied in obtaining his Higher National Certificate and, the more complete his mechanical engineering training, the better will be his ability to absorb the specialized training.

I think at this stage we should consider again our

requirements. I would put these into five categories as follows :—

1. Administrative.
2. Purely technical *i.e.* design, research.
3. Technical—Commercial *i.e.* Engineer Salesmen.
4. Production Engineers.
5. Installation Engineers.

For the first the broadest education is essential, superimposed on which a specialized training in refrigeration is desirable. This will certainly be the smallest of the five groups and recruitment must vary between different companies. A graduate with a first degree, or if possible a higher degree or a Dip. Tech., can be given a works training period of two years, after which special training depending upon the position to be held will be arranged.

For the second and third groups, the training I have described up to the age of 21 will give an excellent foundation ; alternatively, the graduate with a two year post graduate works training can provide excellent material. Both groups need the specialized refrigeration training and it is during this period that the aptitude for either the technical or the technical-commercial will become manifest. It is the latter which require the rare quality of the good technical brain combined with what is often called a good business head. This man must be fully able to design a plant, perhaps not down to the last detail, and then to arrive at its cost and to go out and sell it, and to maintain contact with his client until the plant commences to function, fulfilling the purpose for which it was required by the client.

For the next group, that for production, training is already well established and requirements for production of refrigerating plant do not pose any special problem that the qualified production engineer cannot handle.

For the installation engineer, although a training in refrigeration would be desirable, it is found in practice that they have rarely gone as far as the Higher National Certificate and can hardly be considered in the technician class. Their refrigeration training is usually one organized by individual companies to suit the particular equipment that the man is likely to be called upon to install.

Earlier in this address I dealt with the various Government statements concerning technological education but purposely omitted the scheme for national colleges.

In this country there are several industries which are relatively small in size, but which nevertheless have an important place in the national economy. They need trained engineers and scientists, technologists and technicians ; yet the small total numbers involved make the provision of this training difficult. Traditionally, the local technical colleges would be expected to provide part-time or evening courses for this purpose, but they are unable to do so adequately when the number of students in any one area is very small. The cost of providing the necessary equipment for advanced courses would not be justified in such cases on a regional basis. Only by concentrating all students in one or two institutions is it possible to offer the necessary facilities for training.

The Percy Report of 1945 recommended that the responsibility for technical education for these rather special industries should be transferred from the local authority to the Central Government. It proposed the setting up of a number of national colleges, each catering for a particular industry or related group of industries. By so doing, first class teaching staff, well-equipped laboratories and other facilities can be provided for each specialist college for the benefit of all students in a particular industry, wherever they may live. Since it was seen that the students attending these colleges must come from any part of Britain, and indeed from overseas, the courses must necessarily be full-time ones and the colleges themselves, where possible, residential in character. Their governing bodies, which are appointed by the Minister of Education, are drawn from the industries concerned and included also are representatives from other educational bodies, the trade unions concerned, the Trade Union Congress, employers' associations, the senior professional institutions, D.S.I.R., a university, local government and an assessor from the Ministry of Education.

One of the first of these institutions was our own National College for Heating, Ventilating, Refrigeration and Fan Engineering, founded in 1948. Other colleges are the Royal College of Aeronautics at Cranfield, the National College of Horology, the National Foundry College in Sheffield, The National College of Rubber Technology and the National College of Food Technology.

In the case of our own National College, this began in some extremely restricted accommodation at the Borough Polytechnic. It very soon outgrew these premises and a new building has been designed and erected on a site near the Borough Polytechnic and is to be formally opened by the Minister of Education, Sir David Eccles, next month.

A great deal of thought and effort has been put into the design of this building, both by college officials, staff and members of the governing body and we believe that it will embody all the most modern equipment for teaching and will have adequate facilities for research of an advanced nature. The final cost will be over a quarter of a £1,000,000.

The detailed work of the college has been described elsewhere and I will therefore omit any such description, but I would like to assure you that the diploma course is planned to provide a training in refrigeration technology which is as broad as it is possible to give in one academic year, and at the same time goes as deeply as possible into the underlying techniques which are vitally important. In other words, it is intended to give the student who has already received a sound mechanical engineering training the specialized knowledge which will enable him to take his place as a technologist well able to tackle the problems met with in refrigeration to-day.

There is also at the National College an associateship course which can be taken either solely as a research course or as a course in advanced studies. This is at post-graduate level and the work done may be submitted for a higher degree of London University. The course is open to those already possessing a first degree, or in approved cases the diploma of the National College, and is intended for those who may be expected to fill the highest technical positions.

You will appreciate that in the National College we now have facilities for training that the industry has never before possessed. Hitherto so much could only be learned by experience, which was inevitably a lengthy process. Now, although I would be the first to admit the value of experience and the fact that experience cannot be learned, it is possible to obtain a training which will put the young man far in advance of his fellows who have not had the benefit of that training. He will then certainly be able to gain his experience at a much faster rate, with the net result that the man power in our industry will increase in numbers and be of a much higher calibre.

I have talked a great deal on this subject of training for our industry. I have seen it grow from almost no facilities to the present day, when it is possible for a man in his early or middle twenties to be able to take his place at a level far higher than was previously possible. I believe that it is quite wrong to think that we can carry on in the future as we have done in the past. If we are going to maintain the position we hold in the world of refrigeration, we must raise our sights as they concern education and training. Our overseas competitors are doing so, and so must we if we wish to lead and not be led.

AIR-CONDITIONING TRENDS

during the coming decade

by **BURGESS H. JENNINGS**

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SYNOPSIS

The paper discusses the future development of the air-conditioning industry, with particular reference to the U.S.A., where hardly any new public buildings are designed nowadays without a complete year-round air-conditioning system. A suggestion is made that during the next 10 years air-conditioning will spread into regions having cooler climates, for which three main reasons are given, and also into the hotter and semi-tropical regions. Methods by which this greater demand for air-conditioning will be satisfied are given. Various types of air-conditioning systems are discussed in detail and suggestions are given on their applications. Finally, the use of fuels in the U.S.A. is commented on. Nowadays the heating market is served mainly by gas and oil instead of coal. Electric heating has become increasingly widespread. Other developments are mentioned.

THE air-conditioning industry stands on a threshold of expanding progress and growth during the next decade. The statement is true for the world as a whole, although the author's comments are more specifically directed to the patterns which it is thought will develop in the U.S.A. There, a number of the statistical analyses, which have been made can be used as a basis for extrapolating growth. For example, 1960 statistics showed that approximately 49 per cent. of homes, wired for electricity and using all fuels, are provided with automatic heating. This, of course, does not imply that other homes are not heated in the cold parts of the nation, but it does show that there is still a large untapped market for automatic equipment. In the case of room-air conditioners market saturation is only at approximately 15 per cent. and central residential cooling is at a scant 3 per cent. Thus, although progress has been made, there remains a large potential for growth both in automatic heating and in cooling.

Automatic heating in a residence would customarily consist of a central furnace, burning gas, oil or coal and distributing heat under thermostatic control through warm-air ducts ; or by hot-water piping with radiator or convector outlets ; or similarly by a low-pressure steam system. Because of its greater complexity and cost, and the lesser need for controlling the temperatures in all of the rooms of a residence in summer, as has been mentioned, central residential air-conditioning has been incorporated in relatively fewer homes. Moreover, such homes are largely in the luxury category, except where the warm season is very extended, in which case many moderate-priced residences employ central air-conditioning systems. Thus, for residential usage the single-room conditioner, usually window-mounted with heat dissipation directly to outside, is becoming more widely employed in summmer. Mass production methods have already brought the cost of window units to economic levels and this fact is contributing to an increasing move toward saturation of the remaining market. Nevertheless, in new residential construction more attention is being given in design to methods of installing year-round air-conditioning, and central residential systems appear on the verge of incipient growth patterns to take over a larger fraction of the market.

In new construction of major public buildings, hardly any are being installed without provision for complete year-round air-conditioning. One of the big exceptions to this rule exists in the case of elementary and intermediate-level schools which, because of a tradition, are customarily shut down during the summer months. How long this luxury of allowing the rising generation two to to three summer months without educational responsibility should continue is a philosophical matter which cannot be settled at the engineering level, but straws in the wind indicate that educational activity may employ a larger fraction of total yearly time. If and when schools are operated during the hot summer months, there will be increasing need for air-conditioning if effective teaching and learning are to take place. Already institutions of higher learning in their new construction are making use of air-conditioning for large classrooms and laboratories. It is thought that this trend will move into other schools and complete air-conditioning in many of them will replace the mere automatic central heating and ventilating system.

It is in other public-type buildings that air-conditioning is becoming or has become almost indispensable. This is true for restaurants, stores, auditoria, hotels, office buildings, many factories and other types of buildings. The diversity of types and the unique problems associated with each type of building makes it obvious that a variety of air-conditioning systems and distribution arrangements have come into existence and this paper will endeavour to discuss in a general way some of these patterns and the trends which may be expected from them. Thus, although prediction of the future even for as short a period as 10 years has its hazards there are some conclusions that can be reached with almost cer-

*International Conference on Heating, Ventilating and Air-Conditioning London : 27 September—4 October, 1961. Organized by : The Institution of Heating and Ventilating Engineers.

tainty based on our present knowledge and already established trend lines. The first is that air-conditioning will spread into cooler climates where heretofore its adoption has been considered almost as an unnecessary superfluity. The second is that air-conditioning will move more extensively into the warmer and semi-tropical areas where its use has been deterred by economic inadequacy for its purchase and operation. Here its effect on increasing productivity and initiative will tend to improve economic conditions and be a factor in raising the standard of living. It must be recognized that capital from outside such areas must be available to start such a growth trend.

Several factors are significantly important in influencing the spread of air-conditioning in cooler climates, of which three stand out :—(1) The interior areas of large public buildings require cooling not only in summer but also in winter from the heat generated by lights and occupants. (2) Large assemblages of people often with simultaneous high lighting loads produce cooling loads of a magnitude that cannot be offset by moderately cool outside air without moving it through the space at velocities too high to be acceptable. Such patterns, of course, exist in auditoria and large banquet halls and restaurants. (3) The other significant factor is related to the problem of sun load which alone or in combination with human and lighting loads can create extremely difficult problems for the designer.

Air-Conditioning Systems

With the broad aspects of the air-conditioning now in focus we must face the problem of how technically to meet the end objectives we seek. This can perhaps best be done by describing a basic central system, pointing out its limitations or inadequacies and then exploring the modifications which can be made, either to make it more versatile or to suit special objectives. For many hotels, office buildings, auditoria, industrial buildings and the like a basic central system with essentially the detail shown in fig. 1 may be acceptable and sufficiently

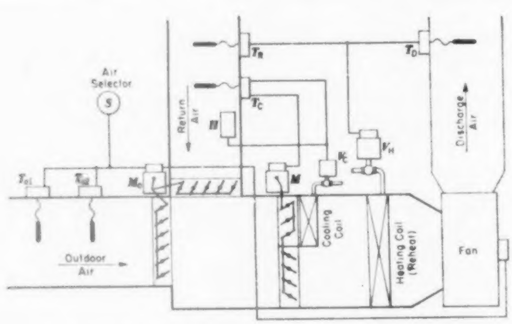


Fig. 1.—A typical year-round air-conditioning system.

versatile to meet all desired objectives. In essence such a basic central system is concentrated in one place and thereby provides for easy maintenance and service. Unfortunately, duct work may be large to even prohibitive size for a system which by air distribution alone provides the extremes of cooling and heating. Not only are ducts required for delivery of air but economy in operation usually here dictates that air be returned to the central unit (recirculated). This means that double the duct work is required and if provision is made to handle all outside air for cooling it means that exhaust outlets or even exhaust fans must be provided to make this possible. In operation, usually the return-air and outdoor-air dampers are interlocked so that they work together under the action of two inlet-air duct thermostats. The first of these would increase the outdoor air from minimum amount to maximum amount as the air temperature increased from, let us say, 32° to 65° F. (0 to 18·3° C.), while the second operates with control in opposite fashion to close the outside air inlet as the air temperature increased from say 65 to 105° F. (18·3° to 40·6° C.), that is less and less outside air would enter and more recirculated air would be employed.

The basic system, in paticular, becomes limited in effectiveness when zones with different types of loads are present and when the physical character of the layout is such as to require long duct runs. Air-conditioning, reduced to its basic framework, involves the transport of energy to or from a space being heated or cooled. Particularly, when loads are large, it can be shown that air used alone has severe limitations for transporting the energy required and because of this a number of system modifications have been developed. For completeness and for reference, a tabulation is made of the various common arrangements, which have been employed, based on the method of transporting energy, namely :—

(1) *Water and air service ; with induction room units ;* air supplied by high-velocity or high-static pressure system and chilled (heated) water piped to unit.

(2) *Variant of preceding with fan on room unit* providing the distribution and with a high-static pressure for air supply not necessarily required.

(3) *Water and air service ; radiant panel at or near terminal ;* conditioned air, in limited amount effectively dried to prevent condensation, is supplied from conditioner ; air is returned to conditioner.

(4) *Water service ; chilled (heated) water provided to fan-coil room unit ;* recirculation of room air over coil by fan, outside ventilation by direct connection and dampers.

(5) *Air service ; double-duct system* provides conditioned air in mixed ratios from two air supplies, one at low temperature, the other at higher temperature for blending in thermostatically-controlled mixing unit, air returns to conditioner.

(6) *Air service ; single duct or conduit system* provides conditioned air often at high-velocity at variable temperatures and in varying amounts to suit space demands ; air returns to conditioner.

(7) *Air service ; single duct or conduit system*, often high-velocity type, provides cool conditioned air and *uses reheat* at terminal to adjust air to serve space demands ; air returns to conditioner.

(8) *Refrigerant-air service ;* such as in window units or below-window through-wall units ; completely self-contained.

Although to a certain extent, the systems are described as named, further comments about them may be made to advantage. The system numbered (1) has been very successful in a number of hotels, office buildings, or other multi-room buildings where space is at a premium and it is desirable to keep the floor to floor space for services at an absolute minimum. The arrangement shown in fig. 2 is essentially that of conditioning supply air at a central point in adequate amount to provide full ventilation requirements in a given space, and in addition provide a trivial amount of cooling or even heating. This conditioned air then enters a high-static-pressure system and passes inside round, conduit-type ducts to different portions or zones of a building. Take-offs from the supply ducts lead into the room requiring cooling or heating service. This air then enters unit conditioners which are usually placed under the windows or at other convenient locations in the room, and the supply air,

after moving through a noise-damping chamber, passes out at the top of the unit into the space. In the unit, by aspiration, air is drawn from the room into the high-velocity stream. The inducted air passes over heating- or cooling-coil surface which is sized to absorb the greater part of the heat load of the square. Provision must also be made for supplying the chilled or heated water to the

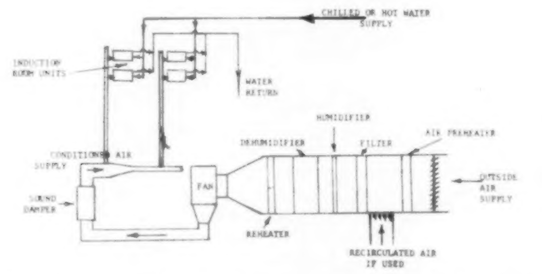


Fig. 2.—A representative layout of a single-duct, induction unit system.

coils of the unit. Although these systems are not ideal in many ways, they provide reasonable comfort with maximum utilization of building space, particularly in rooms at the periphery of a building such as are found in hotels. Such systems are not satisfactory for spaces with high internal loads, such as public dining rooms or auditoriums. However, it should be realized that even here use of high-velocity air distribution systems can be quite satisfactory if provided with proper types of distributor outlets. Sometimes a fan instead of merely the air induction principle is used in the unit conditioner, as noted under item (2).

The double-duct system of item (5) is achieving wide acceptance in a number of design for multiple-occupancy space. In such systems, two supply duct mains are installed (fig. 3). One of the ducts is provided with cooled conditioned air, the other is provided with warm conditioned air. The two types of air are then led into a mixing unit which proportions the amount of cool and warm air to give the precise air temperature required for the conditioned space. It is possible to keep the cooled air duct within reasonable size limits by having the air from 25 to 30 degrees lower than the desired space temperature before admixture with any warm air. The warm air duct is tempered usually not far from room conditions. The mixed-supply temperature differences in the dual-duct system are appreciably greater than those conventionally used in ordinary single-duct systems, as these range from 12 to 25 degrees below space temperature for customary summer operation, and from 15 to 35 degrees above space temperature for customary winter operation. A third duct for returning all of the air except that used for ventilation is nearly always provided. The central conditioner dehumidifies and cools all or a controlled fraction of the recirculated and ventilation supply air and then the output is sent to the cool and warm ducts with the warm duct air being reheated as much as required before entering the duct. The mixing boxes at the space inlets must properly proportion the cool and warm air under thermostatic action and quietly deliver it into the conditioned spaces. Control of humidity with either of these systems is not extremely flexible as the same type of air goes to each space and precise humidity control will only exist for the basic-design sensible heat ratio. However, unless there is exceptional unbalance in the type of latent load of the spaces served, serious trouble is not experienced. High-static pressure, high-velocity distribution or a normal duct distribution pattern can be used. The volume flow set by summer requirements is not varied greatly as the usual control arises from the ratio of warm and cool air.

The problem of different zones in a building with widely varying requirements has been mentioned before and categorically is listed as item (7). One zoned manner of operating is illustrated in fig. 4 where several building zones or room areas are shown each responsive to individual thermostats, T_1, T_2, T_3. For winter operation the main air supply, returned from the zones and with

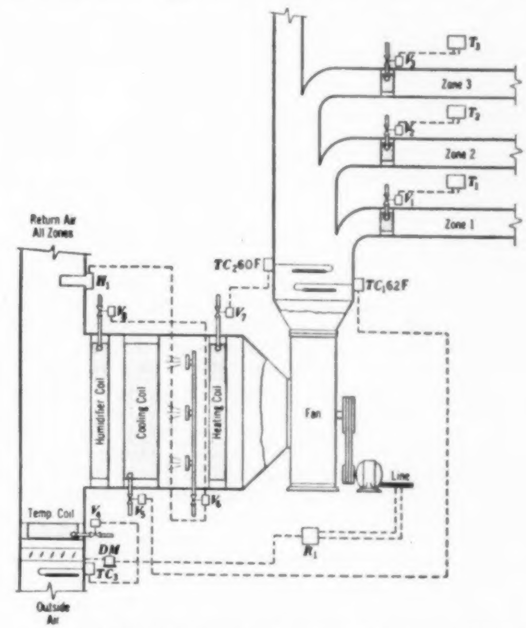


Fig. 3.—Heating and cooling system using zone control.

ventilation air from outside, first passes through a humidifier warming coil which operates in connexion with humidifier sprays. A heater coil follows the sprays. For summer operation the first coil is not used and the system air is chilled by the cooling coil. The following heating coil under the action of a limit temperature control TC_2 goes into operation only if the air temperature falls below a limit value of, say, 60° F. (15·6° C.) or less. This can occur if excessive dehumidification is needed. A second limit switch (TC_1) operates to increase the cooling should the air temperature exceed a set value, say, 62° F. (16·7° C.). The zone thermostats reheat as necessary. In the figure the letters (V) refer to control valves and (DM) indicates the damper motor.

Having tabulated a number of approaches and methods at our disposal it naturally follows that one might expect that the next step would be to generalise and state which systems are used for the different sets of circumstances which might arise. Nothing could, however, be more unwise than to take such an approach. Each system is necessarily a law unto itself and should receive the benefit of clear thinking with the end result coming out as a happy composite of several approaches. The problem is also complicated by the fact that consideration must be given to whether the building is a new structure or whether it is an old one into which air-conditioning is being installed for the first time.

The economics of the design situation also cannot be

overlooked and three criteria, at least, most always be here given careful study in an effort to reach the optimum pattern for the owner or user. These are : (1) First cost of the system and its equipment ; (2) The amount of usable space taken out of use because of space required for the conditioning equipment, duct and pipe runs ; (3) The cost of operating the equipment under the loading conditions which it is expected will be encountered. Each of these items is important and the designer is frequently faced with a serious challenge as to how to reach an optimum.

Where space is at a premium as in offices or hotel rooms in the peripheral areas of buildings individual induction units in the rooms without air return have been very satisfactory. The use of double-duct, high-velocity systems has also been very acceptable and with these systems air return can in many cases be justified without undue taxing of rentable space. But it is in the realm of the large building with interior spaces requiring year-round cooling that the designer can show his greatest ingenuity. Moreover, many effective designs have been developed some of them sufficiently ingenious as to justify the complication of the designer making patent application and then licensing the design. One such arrangement involves operation of the cooling system year round and using the heat pickup in the inner areas in heat-pump fashion to provide the warning in the peripheral areas. Supplementary direct heat is also available in peripheral areas when this is needed particularly at inlet areas. Such an arrangement might be classified as a zoned heat-pump system.

In contrast to a system as complex as this a first reaction might be : use outside air in quantities above the amount needed for ventilation to provide cooling of the inside spaces with spillover into the peripheral areas. This is satisfactory under many conditions, but during between-seasons with mild outside air available, proper cooling can only be obtained with excessive amounts of air flow. This results in disturbingly high space velocities and may require spill-exhaust ducting, extra fans and controls, and the wastage of much additional rentable space. Moreover, the main ducts themselves must be sized for high-flow conditions and thereby be overly large. The problem, in fact, is complex in every way as filters, grilles and all other equipment must also be oversized for such between-season operation. Thus, more and more thought is being given to year-round cooling-system operation for large buildings with transfer of energy between zones being made by means of warmed or cooled liquids instead of air alone.

Fuels in the Future

This discussion should not be brought to its conclusion without some comment being made regarding fuels. About 25 years ago coal was still the predominant fuel for heating purposes but its position was seriously threatened by oil. This change was occurring because the price of oil was competitive with coal and its easy adaption to automatic operation reduced the labour required in operation of the heating system. Almost before oil heating had become solidly entrenched as the leading heating fuel, gas fuel in turn began to take over a larger and larger share of the market. This has occurred because a network of gas distribution pipelines has made natutal gas available to nearly all of the populous areas of the U.S.A. This means that gas is being transported by pipeline thousands of miles in a pattern that was hardly dreamed of 20 to 25 years ago. It is not inconceivable that in Europe, also, greater energy transport by gas line may become significant in the future even through the great distances that may be required.

This fuel revolution in the U.S.A. has brought about significant changes. The heating market is largely served by gas and oil with coal largely being used in the power (electric utility) and metallurgical industries. The effect of the greater availability of gas is moving in directions other than heating. Gas engine-driven compressors have come into use for ordinary air-conditioning. Greater usage is also being made of absorption system units for air-conditioning.

Shifting Peak Load

The electric utilities have already experienced a shift in peak load capacity to summer from winter, caused by the air-conditioning load being added in increasing quantities to their systems. This in turn makes excess generating capacity available to them in winter and gives them an opportunity to invite electric heating load. In a number of instances this is being done very aggressively to the point that electric heating both with and without the help of the heat pumps has become increasingly widespread. This raises the question of whether the time will come when electrical heating seriously challenges the position now held by direct burning of the fossil fuels. We do know that electrical energy is unquestionably predominant for cooling (refrigeration), but it appears doubtful that it will be a leading factor for heating at least in the coming decade. To date the promise of nuclear energy for power generation has not been found to be economically competitive in regions where fossil fuels are abundant at reasonable prices. With the passage of time as the availability of fossil fuels diminishes this pattern will change and then it can be anticipated that a change-over in heating practice may simultaneously occur bringing about greater use of electrical energy.

Thermo-Electricity

Making predictions for even as short a period as 10 years is an extremely questionable practice as a new scientific discovery could completely alter our pattern of thinking. One such discovery is even now on the horizon, namely thermo-electricity. This field is far from new but recent advances in our knowledge of semi-conductors have opened up new vistas for growth and development in it. By merely changing the direction of thermo-electric current flow to a unit its cooling element transforms into the heater of a heat pump and when desired it can again be reversed to cool at will. Added to this is the attraction that there are no moving parts. At the present time ths cost of most semi-conductor elements for the thermo-electric units is high, but it is reasonable to expect that with increased production their cost will drop between one-tenth to one-fifth of present cost. There is also reason to believe that improvements can be made in the performance of the elements. Thus, we appear to be moving toward at least one radically new approach which could have a great impact on air-conditioning, heating and cooling during the next decade, I do not think that this one device will stand alone as we can expect many novel developments from the research laboratories of the world during the next few years.

Modern Refrigeration is obtainable from the manager, Maclaren House, 131, Great Suffolk Street, London, S.E.1, at thirty-five shillings per annum post free to any part of the world.

"R.C.L." solves the parking nightmare

Wholesale firm finds business in new outlook

"WE'D got to the stage where we had to stack goods on the stairs" smiled Mr. H. A. L. Geary, a director of Refrigerator Components, Ltd., as he described the reasons for this well-known wholesale company's recent move.

We were sitting in the spacious new offices which form part of the modern block erected to the firm's design in a new estate in Wandsworth. These premises provide over 7,000 sq. ft. of floor space, spread over two storeys. They are light, with ample window space, and freshly painted, appropriately enough in an icy shade of blue. Quite a contrast to the narrow, four-storey building nearer the city from which the company came, where barely 4,000 sq. ft. of floor space was available and where employees—and customers—had to clamber past the overflow of stock on the stairs.

Transport facilities have improved with the changed area. "We have escaped from the nightmare of parking" continued Mr. Geary, indicating the unrestricted roadway and yard space fronting the building.

A further advantage already becoming apparent after only a few weeks, is the increasing business at the trade counter which is an encouraging sign, even though this department, dealing in small orders, is obviously only one facet of the firm's business.

Manager and Designer

There is a drawing board in the office of Mr. L. J. Wolf (pictured above), managing director of R.C.L., who founded the firm. This spry, 78-year-old, who has no thoughts of retiring, has provided the inspiration behind many of the firm's designed accessories, although, he says, he does not draw so much these days. Service as well as supply is the aim of the company's technical sales staff.

This is the first in a series of articles which will feature firms associated with the refrigeration industry. Whether it be in problems solved, processes developed, personalities employed, there is an interesting story in every company.

In the early days Mr. Wolf was a partner in a firm called Wolf and Morgan, marketing—as part of that company's business in electric motors,—one of the only motors designed for refrigeration which was available in the 1920s. Emphasis gradually changed to refrigerator

A small part of the store department, which extends well back from a wide frontage. Offices are situated above this section.

Neat, compact and functional, R.C.L.'s new building is on two storeys.

components, based on imports until eventually the subsidiary, Refrigerator Components, Ltd., which was started in 1931 and lays claim to being the pioneer in this field in the U.K., superseded its parent firm.

In common with industry generally, of course R.C.L. has felt the pressure of Government financial stringency on its trading—this year will be the first for 10 years that the company has not recorded an improvement on the preceding trading period—but a fresh outlook has been gained, and the overriding impression is of a firm poised to establish more records in the future.

COMMERCIAL AND INDUSTRIAL SECTION

Manufacturers' and Distributors' News

Mr. Robert Broadbent has joined the board of **The British Thermostat Co. Ltd.**, the parent company of the Teddington Group, as executive director. Mr. Broadbent has also been appointed chairman of Teddington Autocontrols Ltd., Teddington Controls (Export) Ltd., and P. W. Baker & Sons Ltd., and has joined the board of Teddington Aircraft Controls Ltd. Mr. C. S. Gardner, managing director of Teddington Aircraft Controls Ltd., and Mr. R. H. Seward managing director of Teddington Autocontrols Ltd., have also joined the board of the parent company. All the above appointments are effective as from November 1, 1961.

* * *

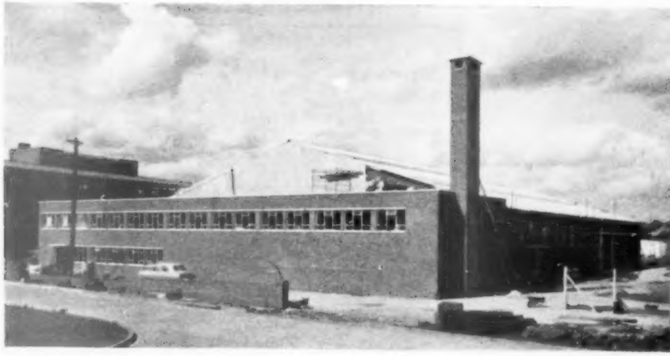
The chairman of **The Rheostatic Company**, Mr. M. J. Gartside, whilst remaining chairman, relinquishes his post as managing director of the company, due to increased managerial responsibility within the Elliott-Automation Group as a whole. He is succeeded by Mr. J. H. Stevens, for many years a director, and the general manager of the company. Mr. Hemsley C. F. Miller, associated with The Rheostatic Company since its foundation 40 years ago, has retired for health reasons and Mr. E. O. Herzfeld, director of Elliott-Automation and Mr. G. C. Fairbanks, director of Elliott Brothers (London) Ltd., have joined the board.

* * *

New H.M.V. refrigerator of 6.8 c.ft. capacity with the de-luxe finish; price is 69 guineas (including tax plus £1 2s. 5d. purchase tax surcharge).

* * *

York Shipley Ltd., announce that Mr. C. J. Powers has been appointed assistant manager of the contracts division of their industrial department. Mr. Powers first joined the company's erection department in 1942 where he was engaged until his transfer to the industrial department in 1953.



The new Northampton premises.

"Spar" wholesalers, **Thomas Linnell & Sons Ltd.** of Gladstone Road, Kings Heath, Northampton, have just moved into the first quarter of their new warehouse on the Kings Heath Estate outside Northampton. The warehouse, planned to be built in four stages, is part of Linnell's over-all scheme to increase the speed and efficiency of their service to their retailers. It is fitted with a cold store. Fork lifts will stack food to a height of 26 ft., and Linnell's serve, from this new warehouse, "Spar" grocers in an area extending from Meridan to Luton, Oxford and Peterborough, and to Coventry, Warwick, Bedford and Huntingdon. An estimated 300 people attended the opening ceremony recently, which was marked by an Australian wine and cheese party. Guest of honour was newly appointed Australian trade commissioner, Mr. Ronald Johnson, whose function it was officially to declare the warehouse open.

* * *

An increase in the volume of business over the last two years created a big storage problem for the **Pressed Steel Company** at their factory at Greenford. The large commercial refrigerators which are stored there could easily be damaged if stacked one on top of another, and a vast area is required to store them side by side. The solution was provided by racking of Dexion slotted angle, built to carry loads of 3 tons. The refrigerators are now stored three high and selectivity is also greatly improved (*photo, page 1232*).

* * *

The "Vibraswitch" is a vibration sensitive device that protects rotating and reciprocating machinery from extensive damage resulting from mechanical malfunction. When the vibration level of a "Vibraswitch"-protected machine exceeds normal by a pre-selected amount, an internal switch closes, actuating either an audible warning system or a shut-down circuit before costly damage occurs. Failing bearings, broken blades and similar malfunctions cause increased imbalance or high frequency vibration detectable with the "Vibraswitch." The "Vibraswitch" is avilable with or without electrical re-set and hold-on coils and can be supplied in water-tight or explosion-proof housings. It is made by **Electro Methods Ltd.**

* * *

MORPHY-RICHARDS INTRODUCE 6·8 c.ft. MODEL

To meet the growing public interest in large refrigerators Morphy-Richards "Astral" introduced recently their largest model yet—a 6.8 c.ft. compressor refrigerator at the low price of 66 gns.

This new model provides, within its 6·8 c.ft. gross capacity, 10·9 sq. ft. of shelving. Its particularly large, full-width freezer compartment stores up to 28 lb. of frozen foods for two to three weeks. This compartment is also equipped with two ice-trays making 2 lb. of ice (32 cubes).

There are three full-width interior shelves, two of which are adjustable to suit various storage needs. Under the third shelf is a deep drawer for vegetable and fruit storage. Below the freezer is a drip-tray and a large chiller for raw fish or meat.

Door storage includes two racks for storing eggs; a large butter and cheese compartment with sliding perspex doors; and two bottle shelves, which store up to five 1-pint *plus* six ½-pint bottles.

"M.R." ISSUES EAGERLY AWAITED IN CANAL ZONE

Among new readers of "M.R." we have been pleased to enrol the Canal Zone Chapter of the U.S. Refrigeration Service Engineers Society. Writing from Balboa, the President, Mr. Clois C. Duffie, states, ". . . after only two copies, I find our 30 members anxiously awaiting the next issue which is passed around and is then filed in our reference library."

A small group of the Canal Zone Chapter displays charter. L. to r.: Ellis Lowe, E. V. Smith, President Clois Duffie, Tony Dyer, C. Dimmick, Vice-President Lee Welch, Ted Mcgann and Les Beauchamp, Sec./Treas.

This modern extension recently opened at the North end of the Ekco Works, Southend-on-Sea, houses the Ekco Plastics technical and administration staff whose previous offices are being used for further factory expansion. The new building provides an extra 14,000 sq. ft. of floor space.

Mr. R. E. Milledge.

Mr. G. E. Johnson.

It is jointly announced by Mr. R. M. Morgan, sales director of **Morphy-Richards (Cray) Ltd.,** and Mr. A. W. Sinclair, sales director of **Morphy-Richards (Astral) Ltd.,** that as a result of the ever-growing expansion and diversification of the M-R Group range of appliances each company now has its own separate sales force. This new move provides an independent "Astral" sales force to concentrate on absorption and compressor refrigerators and spin driers, and a separate "Cray" sales force to specialize in rotary ironers and vacuum cleaners in addition to the wide range of smaller appliances. In this re-organization, the original group sales force has been divided basically into two new sales divisions, with 17 "Cray" sales representatives and 10 "Astral" sales representatives. Three regional sales managers have been appointed to co-ordinate the Astral sales activities, divided into three major regions—north, midlands, and south. Mr. D. S. Reid, previously M-R Group Scottish area manager, has been appointed north region Astral sales manager. This region includes Scotland and north England and Mr. Reid will operate from Morphy-Richards (Astral) Ltd., 116, West Campbell Street, Glasgow, C.2. (Phone : Glasgow Central 1997). Mr. R. E. Milledge, previously M-R Group Midlands area manager, has been appointed Midlands region Astral sales manager. This region includes North Wales and Yorkshire, in addition to the Midlands. Mr. Milledge will operate from Ronlyn, Church Road, Snitterfield, near Stratford-on-Avon. (Phone : Snitterfield 380). Mr. G. E. Johnson, previously M-R Group area manager for S.W. England and South Wales, has been appointed south region Astral sales manager. His region includes London, East Anglia, the Home Counties, and South Wales, in addition to the whole of South England. Mr. Johnson will be based at Morphy-Richards (Astral) Ltd., 50 Conduit Street, London, W.1. (Phone: Regent 4080).

Mr. D. S. Reid.

This bank of six of the new vertical scale, mercury-in-steel thermometers by British Rototherm Co. Ltd. measures only 9¾ in. long by 11½ in. wide. Scale markings are in °F x 100. The thermometer can be supplied singly or in any number.

SHOP REFRIGERATION NEWS

DESIGN FOR SELF-SERVICE

HIGHER LEVELS FOR TEMPERATURE-CONTROLLED DISPLAY OF PERISHABLES

By Our Special Correspondent

I HAVE said several times in this review of the progress of refrigeration at retail level that the makers of cabinets are not giving sufficient attention to design for self-service conditions. There are exceptions, of course, but still too few of them to make the assertion unjustified.

It is the small shop I am thinking about primarily. There are many instances of quite understandable refusal to buy a refrigerated cabinet for the display of provisions, dairy goods, cooked foods, and delicatessen on the grounds that it would take up too much floor space. Always, unless a convenient recess can be found for it, there is that infernally inconvenient bulge of anything from 9 in. to 1 ft. 3 in. beyond the front of the line of shelves.

The same criticism can be made of the quick-frozen food cabinet, but as it is the only means of selling these products which are virtually essential to every food shop, the retailer puts up with this bulge: accepting this regrettable intrusion upon the floor area allotted to customer circulation as unavoidable.

What brought this matter to my mind again was a visit to a quite small self-service shop in Welwyn Garden City. Typical of its kind, in having a central gondola and open-fronted canopy-topped wall shelving with five levels of help-yourself display, this very successful little business belonging to Mr. T. K. Glaves is quite untypical—almost unique, in fact, in having a refrigerated cabinet for perishables with four levels of refrigerated display and a maximum depth (from front to back) of 2 ft. 3 in. It is 6 ft. 6¾ in. long, and thus approximates to the average length of the normal type of refrigerated display cabinet.

As will be clearly seen from the first of the accompanying illustrations, these dimensions make it possible simultaneously to produce four conditions that make this cabinet most suitable for self-service:

(1) It is easily incorporated into the plan of the shop as a unit in the wall-shelving system.

Four levels of refrigerated display are provided by this wall cabinet installed in a small self-service shop at Welwyn Garden City by J. P. Page & Co., Ltd.

The contrasting depths (from front to back) of one of the earlier Manhattan cabinets and the three-decker Forum installed in a discount supermarket at Hemel Hempstead. "M.R.'s" artist has superimposed the white line on the photograph.

(2) Perishable stock can be presented under temperature controlled conditions at eye-level or just below.

(3) All four levels of display are brought within range of the lighting provided by the fluorescent lamps partially concealed in the canopy.

Two of the new "Frigidaire" Carnival display cases installed for Granville Supermarkets Ltd. at their new self-service store at Woodford. The further case displaying bacon and cooked meats is fitted with high glass risers for counter assistance.

(4) The bottom level of display does not project further forward than the bins at the bottom level of the normal wall fitting.

This cabinet is a product of Robert Wahl, one of the leading manufacturers of refrigerated equipment in West Germany, and was installed by J. P. Page & Co. Ltd., their distributors in this country.

Frigidaire are one of the manufacturers of refrigeration equipment who, in conjunction with their ationally-spread distributors, have been giving careful thought to self-service requirements, and in particular to the design of cabinets providing means for refrigerated display at higher level.

One example of this development is the Forum, a three-decker cabinet with a display area of 20 sq. ft. The maximum depth of this cabinet from front to back is 2 ft. 5 in., and it is 5 ft. 7 in. high. The dimensional advantages of this cabinet, as compared with one of normal type are well brought out in the side-by-side installation shown in the second illustration.

The adjoining cabinet seen on the right-hand side is an earlier version of the Manhattan models. This, for purposes of making my point, is a very convenient juxtaposition for it effectively demonstrates the difference in the depth as well as the contrast in the display capacity of the two cabinets. It also shows the degree to which the one-level display type projects as compared with the three-decker model, whose base is no more than a few inches further forward than the base of the adjoining wall shelving.

In one respect, however, this two-cabinet installation is not a good example, for it happens to be in a large discount self-service store the spaciousness of which makes it unnecessary to worry about the bulge of cabinets beyond the depth (from front to back) of the wall-fittings.

It is solely the small self-service shop with which I am concerned in taking up this matter.

Unhappily there seems little prospect of the same principle of higher level display being applied to frozen foods, in the near future. There are too many

More Frigidaire cabinets at Woodford, Essex.

technical problems involved. There are, of course, the three-tier refrigerated display cabinets which have the lowest level held at low temperature for the display of frozen foods. These may have their advantages where there is space available for one cabinet only, but they make no contribution towards a solution of how to get these products to a higher level of display.

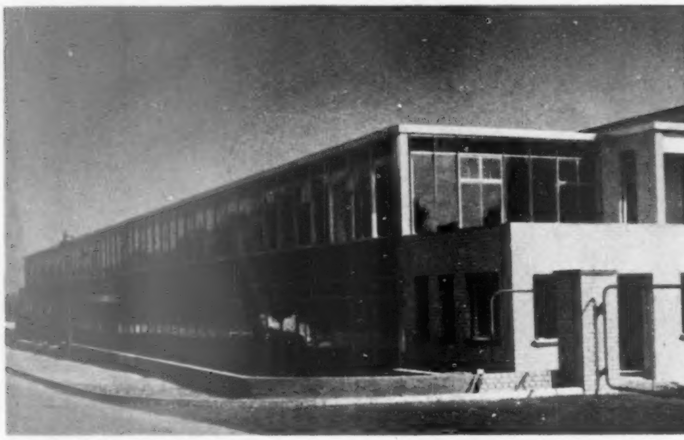
In MODERN REFRIGERATION for October there was a report on the introduction of a new cabinet—the Carnival—by Frigidaire. I am now able to report on an installation of three of them—one for normal refrigeration and the other for q.f.f.—in a small self-service at Woodford, Essex, which, although not itself a supermarket, is owned by Granville Supermarkets Ltd.

BIRDS EYE'S NEW STORE *IN SCOTLAND*

Built on hard core foundations, Birds Eye's new store at Renfrew has a capacity of 154,800 c.ft. or 700 tons (gross) of cased frozen foods. The building itself is of structural steelwork with aluminium cladding on the exterior walls, and insulation is provided by 6 in. of expanded polystyrene on walls and ceiling and 8 in. of cork on the floor. To prevent frost-heave there is an electric heating mattress under the floor. Insulation work was carried out by Smiths Insulations Ltd. To maintain the store at the required temperature of −5 degrees F., refrigeration is supplied by two Lightfoot compound ammonia compressors driven by 25 h.p. motors.

Above: Quick-frozen products are transferred directly from the cold store to insulated vehicles for delivery to shops and caterers.

Left: Interior of the new Renfrew cold store. Pallet loads of frozen foods are stacked by high-lift truck while men in Arctic suits make up orders for retail and catering customers.



The new office block at Dunton Green.

West Kent Cold Storage takes another step forward

OVER 200 visitors, with varying interests in cold storage, were present to witness the opening of the latest section of West Kent Cold Storage Co. Ltd.'s enterprise at Dunton Green, Kent, on November 17, by Lord Cornwallis, who signed the first page of the visitors' book.

Things are, in fact, going " according to plan " for this rapidly growing business, the premises for which were founded, surprisingly, on the site of what had been, for many years, a lake. Few signs of the lake exist today. Rubble from London's bomb-sites was brought in to provide foundations for the cold stores which chairman and managing director, Mr. W. Davison, had envisaged as the modern trend.

Today Mr. Davison's dream has come true. " Tall oaks from little acorns grow," said Lord Cornwallis in his opening remarks. There must be a feeling of triumph, not only in completing the new building but in the personal achievement, he thought. They were witnessing something that was typically British in a business started because somebody had had the courage to take on a job and, by " guts," see it through. He was delighted to open the administrative building.

Mr. Davison paid tribute to his staff, " for without their co-operation this project could not have been." He felt the achievement had been great, and had gone a long way to putting Dunton Green on the map. He forecast further development in the way of the home market in which he would like to think the company would participate.

The story of success—incidentally the title of a brochure published by the company—started in 1945 with the purchase of the lake at Dunton Green. Demand for the earliest installations, established in 1953 to provide 9,000 sq. ft. of dry goods storage space and cold storage of 36, 000 c.ft. was so immediate that the further extensions planned were fully justified. By 1955 six cold storage chambers had been added giving a total capacity of 80,000 c.ft., and a covered loading bay of 6,000 sq. ft. which can take 10 trucks at a time had been constructed. Total cold storage capacity now stands at 355,580 c.ft. with temperature ranges down to −20° F. and the dry storage capacity has risen to 1,000,000 c.ft.

The service of the company has not been limited to storage facilities, however. In 1956 one large frozen food company had started renting offices, garaging and van-refrigeration points in addition to its cold stores. Special production lines for pre-packed meats and oven-ready poultry were inaugurated in 1957–8.

Administration for the organization demands modern office accommodation. The new building should fulfil this need very adequately. Total office space on the site now is approximately 13,000 sq. ft.

Fronting on to Rye Lane, from which an excellent impression of the wide window area and attractive frontage can be gained, the new office block was started in February. Externally clad in black vitrolite glass, with polished aluminium mullions and transomes, the building is equally interesting inside. A wide stairway confronts the visitor stepping into the spacious entrance hall. Office facilities are similar on ground and first floors.

Throughout the building under-floor heating is provided by passing hot water through a series of pipes, heat being taken from sections of the refrigeration plant through a heat exchanger, and an oil fired boiler of 750,000 B.t.u.'s capacity is incorporated in the system, thermostatically controlled, which will act as a heat booster as and when required, to maintain office temperatures at required levels.

Construction was carried out by Walter Smith (Contractors) Ltd., and completed in October. John Gardner (Super Markets) Ltd., have already taken a long lease on half of the first floor.

Morphy-Richards Introduce 4.6 cu. ft. Model

Morphy-Richards (Astral) Limited are intensifying their traditionally vigorous and successful low-pricing policy by introducing a 4.6 cu. ft. absorption refrigerator to retail at the highly competitive price of 47 gns. including tax. The breakdown of the 47 gns. retail price is net list £40 19s. 0d., purchase tax £7 12s 9d., plus surcharge 15s. 3d.

Mr. A. W. Sinclair, sales director of Morphy-Richards (Astral) Limited, states: " During the summer season we substantially increased our share of the total market with the outstandingly successful A.350 model and the already well-established A.400 " Commodore " and A.200 table model. Late in the season we introduced the A.680 compressor refrigerator and in the short period this has been on the market it has proved very successful. In addition to our current range, we are about to launch this new 4.6 cu. ft. model which will replace the A.400 in the most popular size range.

Formal Opening of National College

ALTHOUGH operational for almost exactly a year, the fine new five-storey building of the National College for Heating, Ventilating, Refrigeration and Fan Engineering, had to wait until November 20, 1961, for its official opening. Appropriately enough, the ceremony was performed by the present Minister of Education, Sir David Eccles, whose predecessor had established it in 1948. He addressed over 100 visitors—representatives of many of the firms who have assisted in equipping the college, and those connected with work at the college—in the excellently designed lecture hall, which has its own air-conditioning unit.

Sir David was introduced by the chairman of the board of governors, Mr. H. A. Secretan, who welcomed him on behalf of the board and fellows of the National College. He spoke of their gratitude to the Ministry which had agreed to a grant of £237,076 towards the cost of the building, and paid tribute to the far sightedness of the industry which, taking into account the gifts in equipments as well as gifts in cash, had contributed more than £65,000. He referred to the naming of the lecture hall as the Nelson Haden Lecture Theatre in commemoration of Mr. George Nelson Haden, the late chairman of Haden and Sons, Ltd., and a former governor of the college, whose firm's very generous donation to the college had made the theatre possible.

Mr. Secretan concluded with a reference to the need for more hostel accommodation.

Sir David Eccles was clearly impressed with what he had seen in a tour of the new college, and he spoke of the importance of the project. He could not think of any other example of a college " living off a kitten."

Concentration was necessary because of the nature of the industry (in fact early recommendations were made to this effect by a Government Departmental Committee on Higher Technological Education). The annual value of the whole group of heating, ventilating and refrigeration industries, the Minister said, had been given to him as £75,000,000. Here was a very big and important industry and perhaps more important, here was a growing industry.

Speaking from his personal experience of refrigeration, the Minister lamented the loss of seasonal foods which in the past could be pleasantly anticipated. Now he did not know of a village in Wiltshire—the area of his own constituency—where there was not a deep freeze in the village post office. The asset was the immense improvement in the nation's diet.

With this scale of industry he questioned whether they were doing enough to educate. " Are we really doing all we know to keep in the forefront."

Sir David emphasised the need for full backing for Dr. D. R. Scott, head of the college. He wished also to associate himself with the chairman, Mr. Secretan, in thanking the industry for the help they had given.

On research he urged the industry to think far ahead. " I know that if our country does not put enough money into higher research, you and I, and our children, are going to have a rough time," he said. It was a long-term investment.

The imposing façade of the National College.

Dr. J. W. Cooling, thanked the Minister for his address.

Some of the equipment installed in the new college was featured in the February issue of MODERN REFRIGERATION this year. On this occasion it was possible to inspect the practical layout and the progress made.

The college facilities are impressive, when one considers that until recently its work had to be conducted in three rooms of an aged school previously used as a girls' school. It provides for full-time courses up to and including post-graduate work in refrigeration, heating, ventilating, air-conditioning and fan engineering. Part-time day and evening classes and training in research methods are also offered to students.

It is estimated that the final cost of the new building will exceed £300,000—money well invested.

Providing some 40,000 sq. ft. of accommodation, the college is equipped with a wide variety of air-conditioning plant. All laboratories on the lower levels have mechanical ventilation employing ducts conveying air at conventional velocities, whilst the refrigeration laboratory has an exhaust system for the rapid removal of fumes. One self-contained department can supply its own climatic changes independent of the building's main

conditioning plant, for research and experimental purposes.

On the roof the refrigeration and air-conditioning machinery for the upper floors is housed, with a water-cooling tower and evaporative type condenser. All systems are fully instrumentated for the students' benefit.

In the heating plant laboratory all boilers are operational and connected into the pattern of the building.

Architects for the new college building were Messrs. Norman and Dawbarn, Messrs. Inman and Partners were the quantity surveyors appointed. Higgs and Hill, Ltd., were builders and Messrs. J. Roger Preston and Partners acted as consulting engineers for the complete mechanical services for which Benham and Sons, Ltd., were contractors.

THE ENTROPY CLUB

THE eleventh annual general meeting and dinner of The Entropy Club was held at Beale's Restaurant, 368-374, Holloway Road, N.7, on Saturday, October 28, 1961.

At the a.g.m. Mr. F. Hagger was again unanimously re-elected president, Mr. J. K. Hadley hon. secretary and treasurer, Mr. G. E. Virgo relinquished the office of " news editor " and Mr. M. Tiley undertook this duty. Messrs. B. W. Corston and Mr. W. J. Vandome were elected hon. auditors. Mr. W. J. Vandome having served for three years on the committee, the last two years as chairman, was not eligible for re-election to the committee. The new committee comprises Messrs. P. E. Bastick, M. Boast, R. Evans, B. M. Rogers, B. Singh and F. Wallis, and were requested to make arrangements for the spring and summer functions, and to make suggestions for revising the club rules. The a.g.m. and dinner have since the inception of the club been held on the same day. Next year, however, the a.g.m. will be held in mid-February and the dinner has been provisionally arranged for Saturday, October 20.

Mr. Vandome took the chair at the dinner and 52 members and guests were present, this being the biggest attendance since the inception of the club. The official guests were Mr. James Douglas, director of Messrs. L. Sterne Ltd., representing the refrigeration industry, Dr. J. Fidler, O.B.E., B.SC., PH.D., and current students from the National College.

Mr. James Douglas proposed the toast of " The Club." He then congratulated the founders in their foresight in forming the club which was setting such a fine standard ; it could only do good, keeping people in touch so that they shared experience. He had many years ago been associated with a young club and like theirs many members went overseas ; to ensure contact was maintained invitation cards sent to members who were unable to attend. These were returned giving details of their activities and whereabouts and were passed round the table. Mr. Douglas then mentioned the changes in his lifetime saying that the industry had now gone scientific. In conclusion he said the membership was now 128, 20 members having joined in the past year, which showed its vitality.

Mr. M. Boast, in replying to the toast, said that the club was founded in a local hostelry near the National College. They were indebted to the advice and guidance of Mr. G. L. H. Bird, father of the club, and Mr. F. Hagger, president and secretary at its inception. They had several overseas members trained in the National College who were upholding the high standard of British-trained engineers. He referred to the advance of refrigeration and sincerely thanked Mr. Douglas for his address.

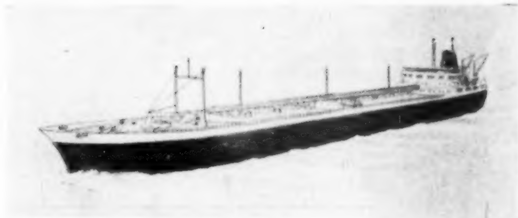
Mr. M. Tiley proposed the toast of the guests who were prominent members of the industry. They were very fortunate that Dr. J. Fidler did not follow the call of shipbuilding of his native Tyneside. He had travelled widely and read many papers as well as his contributions to the Institute of Refrigeration. His work in the field of food preservation and as president of the technical board of the International Institute was well known. His hobby was colour photography, but as a contrast Mr. J. Douglas, their other guest, preferred strolling ; his affection for this sport was no doubt gained in manoeuvres when he was a major in the Home Guard. Mr. Douglas had served a studentship at Albion Motors, graduating at Glasgow University. He had migrated to London in the water-softening business, later becoming a sales representative in the refrigerating industry, then manager and now a director of his firm.

They were very pleased to have these guests with them as well as the current students from the National College who were perhaps not so well known but were passing through the finest entrance in the world for such prominence.

Dr. J. Fidler, in reply, said that the club was a good institution, was educational and gave good advice. He noted that several students came from remote places and no doubt the compressor was worked by buffaloes. He stressed the value of obtaining a qualification and having addresses but felt it was preferable to be reticent.

Mr. Vandome, the chairman, said it was a pity all members could not attend this function ; he proposed the toast of " Absent Friends " and then thanked Mr. Bird, Mr. Hagger and the officers for their work on behalf of the club.

LIQUID METHANE
Import Plan Approved



THE aptly named "Methane Pioneer," a tanker converted to carry liquid methane experimentally from the Gulf of Mexico to Britain, has indeed become the pioneer for a full-scale commercial venture, according to an announcement made early last month by Sir Henry Jones, M.B.E., chairman of the Gas Council. She is not, however, likely to be employed in the undertaking, for which two specially designed tankers are to be built, to import liquid natural gas from the Sahara. These ships will each have a capacity of some 12,000 tons.

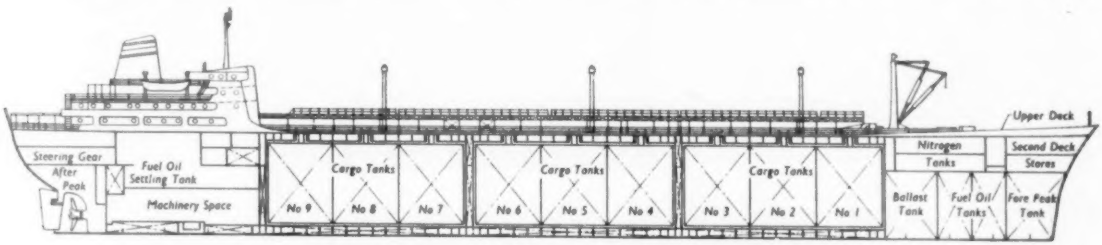
Owned jointly by the Gas Council and Conch International Methane, Ltd., the "Methane Pioneer" made seven trial voyages across the Atlantic between January, 1959 and March 1960, carrying on average some 2,000 tons of liquid natural gas, which, after conversion, was served to its consumers by the North Thames Gas Board. The experiment was completely successful, and led to the plans for a commercial scale project which were approved last month by the Minister of Power, Mr. Richard Wood.

Lower costs of gas supply, but, in view of the extended period being considered, not necessarily lower costs to the consumer, were forecast by Sir Henry. Deliveries, when they start in about 2½ years' time are expected to contribute some 354,000,000 therms per annum, or about 10 per cent. of total gas supplied in this country.

Gas will be piped through an existing main from Hassi R'Mel to Port Arzew, near Oran, there to be liquefied in plant to be installed by the Compagnie Algerienne de Methane Liquide. This is an Algerian company, 50 per cent. owned by Conch International Methane Ltd., 26 per cent. by S.N. REPAL and C.F.P.(A), which are French Government controlled companies owning and producing the gas, and 24 per cent. owned by other French interests.

At −258° F. methane occupies, in liquid form, only about 1/600th of its original volume as gas, making it an attractive bulk transport proposition, after problems of maintaining the necessary temperatures had been overcome. Liquefaction plant and harbourage facilities which will have to be developed at Arzew are estimated to entail an overall investment by C.A.M.E.L. of some £14,000,000.

Output resources at the Hassi R'Mel field in the Sahara from which the methane will be drawn are said to be sufficient to supply gas on the planned scale for many years.



Longitudinal section of latest design of methane carrier.

When it arrives in Britain, the liquid methane will be stored in tanks to be built by the North Thames Gas Board near their existing tanks at Canvey Island, Essex, which, incidentally, will also be used. It will then be pumped to regasification equipment and thence transmitted through a new steel main laid for the purpose to at least seven of the 12 area gas boards, North Thames, Eastern, South Eastern, Southern, East Midlands, West Midlands and North Western.

Designed solely for the transport of their low-temperature cargo, the tankers to ply between North Africa and Britain will have a service speed of 17½ knots. Their dimensions, owing to the low specific gravity of liquid methane (0·45 compared with water) will be conventional —610 ft. long overall, 80 ft. beam—corresponding to a normal ship of 28,000 tons displacement.

U.K. terminal for methane at Canvey Island.

Costing about £7,000,000, the vessels will be built by Vickers Armstrongs Ltd., and Harland and Wolff Ltd., at Barrow and Belfast respectively, to the specifications of Conch International Methane Ltd., which is 40 per cent. Royal Dutch Shell Group, 40 per cent. Continental Oil Company and 20 per cent. Union Stock Yard and Transit-Company of Chicago.

British Methane Ltd., owned 50 per cent. by the Gas Council and 50 per cent. by Conch International, will be responsible for transportation of the gas and will charter the tankers on a long term basis from two ship owning companies, one a U.K. subsidiary of Conch and the other Methane Tanker Financial Co. (Houlder Bros. Ltd.).

A member of the staff of the Humber Laboratory, Hull, using a special resistance thermometer developed at the Torry Research Station. He is checking the temperature of fish fillets in a commercial factory.

HUMBER RESEARCH STATION'S *open day*

WHAT, precisely, goes on behind the inscrutable curtain walling of the Humber Laboratory of the D.S.I.R. at Hull ? Most people, of course, know that—in the words of the D.S.I.R. itself—the work is aimed at improving the fish industry's methods of handling processing and distributing the £155 million-worth of fish eaten in Britain every year. The Humber Laboratory maintains an advisory service in addition to its practical research programme, and in conjunction with the parent station at Torry, Aberdeen, study is currently being made into methods of fish storage aboard trawlers, thawing of frozen fish, quality control at the ports, transport of fresh fish inland, and its treatment when it finally reaches the fishmonger's slab. All these studies are known, but the first public opportunity to observe operations at the Hull station came last month, with an open day closely following the completion of a new £40,000 wing.

Freezing at sea is one of the major concerns of the Humber and Torry research stations at present, and part of the tour was devoted to illustrations of the deterioration of fish exposed for extended periods to varying and relatively high temperatures. The R.V. " Sir William Hardy "—Torry's research trawler—employs a vertical plate freezer designed at the station to freeze the catch as whole fish at the time of catching. A prime advantage of the system is that a trawler running at an economical speed can be used, as opposed to ships having to make high speed runs to port to land their " fresh " catches.

Thawing has been a large-scale problem with frozen catches, but after three years of close attention a team headed by Dr. A. C. Jason, B.SC., developed a method of thawing by dielectric heating which can, it is claimed, thaw blocks of herring in 15 minutes and of sea-frozen whole white fish in about 40 minutes. As a result of this research two firms, Pye Ltd., and Radio Heaters Ltd., have made this equipment a commercial proposition.

Dr. Jason described the working of a pilot plant at the laboratory to visitors. The principle is not unknown. The fish—or other frozen material, for the process has a bright future in the frozen food industry—comes between two plates or electrodes, connected, in the case of the pilot scale plant, to an alternating supply of over 5,000 volts at a frequency of 36,000,000 cycles a second. By the time the fish has travelled its course by conveyor belt between the electrodes it has risen from a temperature of -20° F. to +30° F., the heat being uniformly distributed throughout the depth of the slab. Speed of operation is easily controlled by the number of " ovens " and the speed of the belt. One of the first commercial scale plants is that installed at the " C " factory of Ross Foods Ltd. in Grimsby.

Advantages claimed for the process, apart from its speed, are that it is economical, can be operated by unskilled labout, saves space, and supplies a defrosted product with no deterioration, no handling problems and little weight loss due to drip.

Strong arguments for the deep freezing of fish were provided by samples at the laboratory. Applying any of the testing methods, chemical or sensory, which the laboratory employ in their quality control experiments, these samples which had been held at -20° F. for 11 months in the case of codling and four months in the case of herring were greatly superior to similar fish kept for corresponding periods at 7° F.

Among the numerous instruments on show at the laboratory, one which may have a significant effect in its application to the freezing of perishable goods was in itself probably the most insignificant in appearance. It was a visual indicator, about the size of a cigarette, which has been developed by Dr. D. L. Nicol to detect any pronounced temperature changes wherever they are

(*contd. on p.* 1281)

The Influence of Environmental Conditions on THE DESIGN AND OPERATION OF AIRBORNE REFRIGERATION EQUIPMENT*

By J. D. GURNEY, B.Sc., A.M.Inst.R., A.F.R.Ae.S. (United Kingdom)

Introduction

In a paper before the U.K. Institute of Refrigeration in April, 1960, (1) the design philosophy behind a small high-speed oil-free reciprocating compressor in the ½ to 5 T.R. (1,500 to 15,000 k.cal per hour) range was described, and certain fundamental requirements which the designer of airborne cooling equipment must consider were briefly tabulated. The equipment must :

1. Operate over the whole altitude range.
2. Withstand a high level of vibration and acceleration.
3. Supply the required maximum performance for minimum weight and space.
4. Use the minimum of power.
5. Have a certain minimum life.
6. Have a high reliability, and be completely automatic in operation.
7. Operate in any altitude.

This paper deals with the first two requirements which embody those concerning the environmental conditions.

Fundamental Effects

The company with which the author is connected entered the field of vapour-cycle air-conditioning early in 1958 when a complete system was designed for conditioning the air supply to ventilated suits on a fighter aircraft and this equipment has already undergone flight trials, both in this country and in the tropics, under operational conditions.

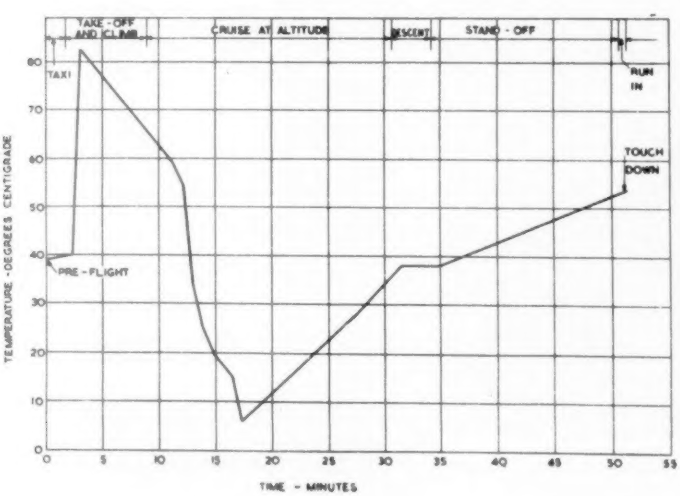
The initial thoughts on this system were that we should use a simple vapour-cycle system composed basically, as in normal practice, of compressor, condenser, an expansion device and an evaporator, and that this system would cool the air supply bled from the aircraft engine compressors.

Now when the requirements tabulated above are considered in relation to this simple circuit, some of its shortcomings become apparent, and this is particularly so with regard to the effect of temperature variation.

In a given flight an aircraft may climb from 14·7 p.s.i. (1·03 kg. per cm²) absolute pressure at sea level to less than 2 p.s.i. (0·14 kg. per cm²) absolute at, say, 50,000 ft. (15,240 metres) altitude, on a route which passes through ambient temperatures varying between –50° C. (–58° F.). and +45° C. (113° F.) at sea level, falling to –70°C (–94° F.) at altitude, while the effect of aircraft forward speed causes the air immediately surrounding the aeroplane to be heated above the general ambient temperature ; as an example, a speed of Mach One is now fairly common at sea level, and, in a hot ambient condition, the resulting ram temperature could be as much as 100° C. (212°F.).

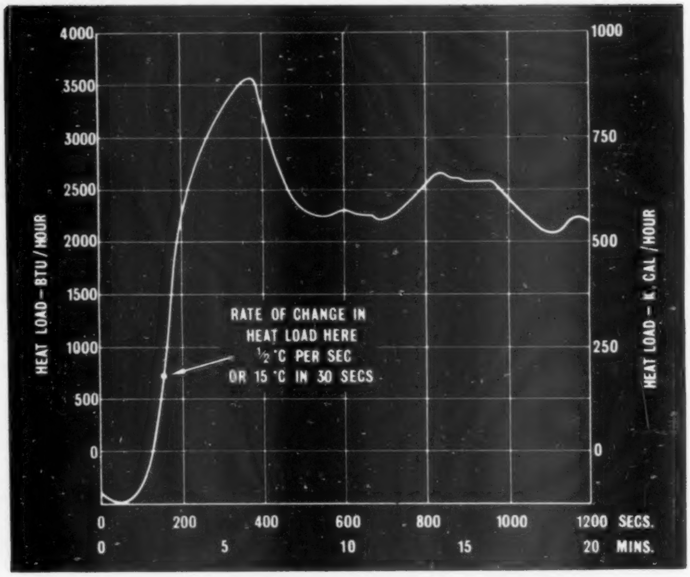
Consequently, components and pipes may be exposed

* Paper presented at meetings of the International Institute of Refrigeration, Commission 3, at Cambridge—September 20/22, 1961.



Plot of bay temperature versus time, representing variation in environmental temperature of components during a typical flight—extracted from flight test data.

Fig. 2.—Showing the rapid rate of change in heat load which can be encountered by airborne refrigeration systems, posing a considerable control problem: the average commercial thermostatic expansion valve takes up to 20 to 30 sec. to settle after a change in conditions.

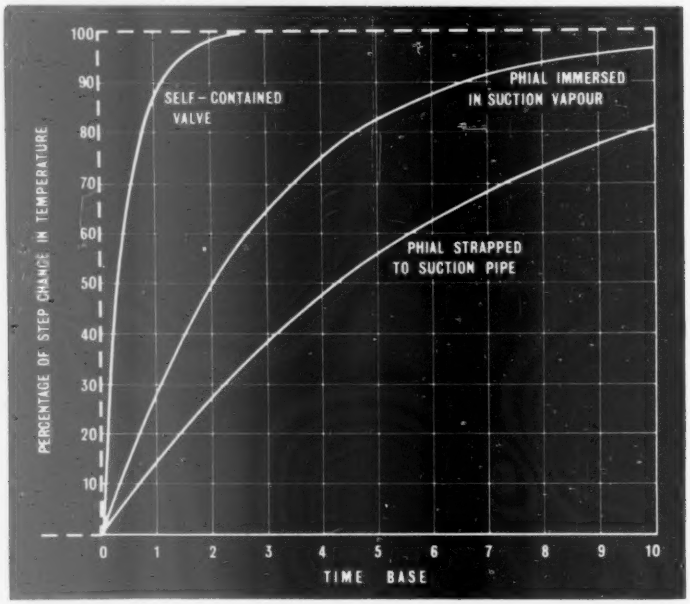


Plot of evaporator heat load versus time extracted from flight test data: U.K. conditions.

to conditions in bays at various temperatures from −70° C. (−94° F.) up to 100° C. (212° F.) or even higher ; these temperatures fluctuate according to the ambient conditions, arctic, temperate, or tropical, according to the altitude, and depend also on the proximity of other equipment such as the aircraft engines and electronic boxes, and on the speed of the aircraft.

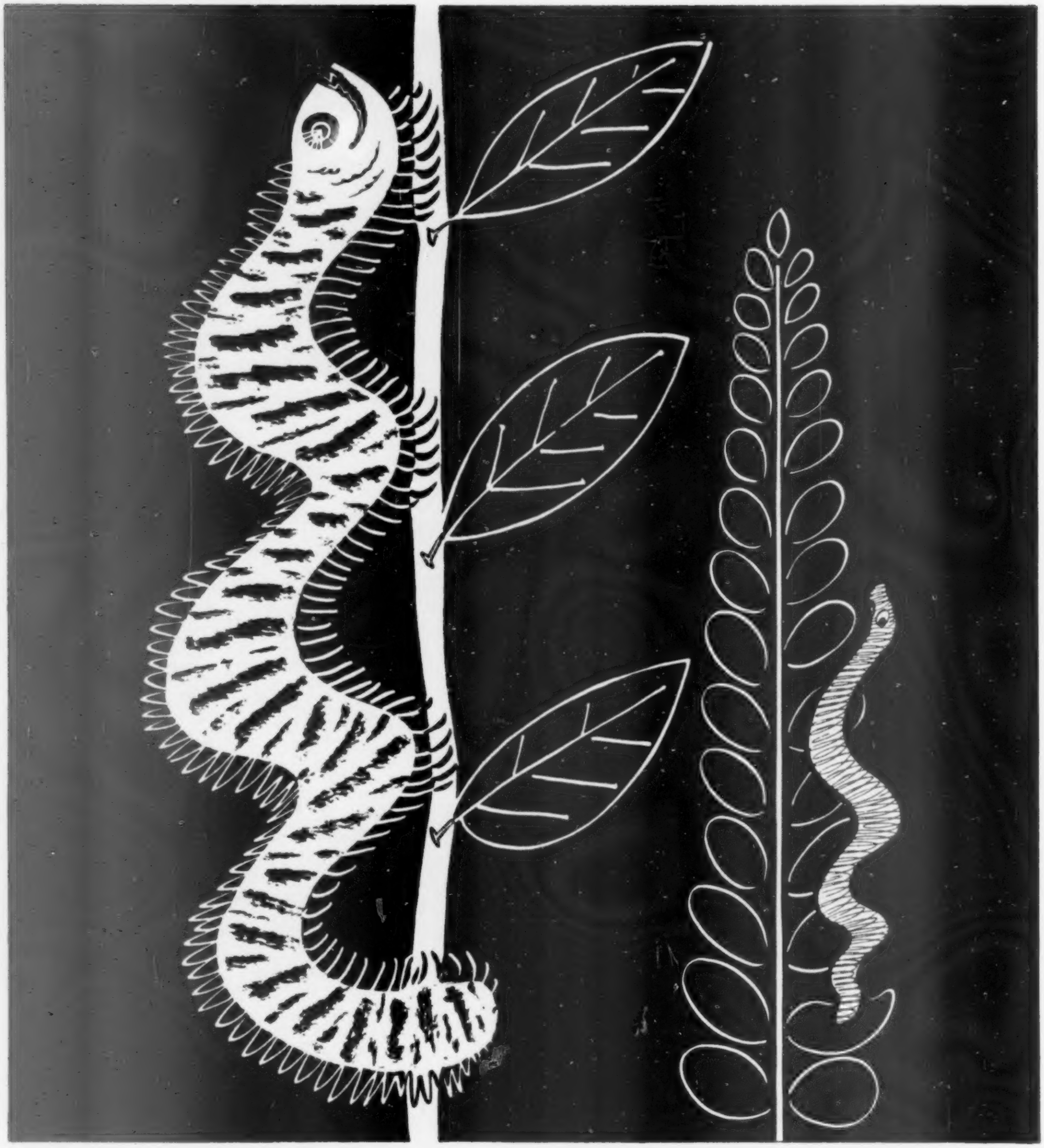
Choice of Compressor Drive and Capacity Control

In looking for weight saving, electrical drive has a disadvantage, since the motor is heavy, and capacity off-loading controls or a variable speed drive are required. A bleed air turbine drive imposes additional power demands on the aircraft engines in terms of tapped air, and ancillary air control equipment would be required.



Temperature response of liquid charged thermostatic expansion valve sensing units.

Fig. 3.—Showing the improved rate of response obtainable from a self-contained valve in which the phial/capillary arrangement is dispensed with.



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In addition we prefer to remain largely independent of bleed air to avoid the difficulties caused by low pressures during engine idling and at high altitude. Where an electric motor drive is a design requirement, we incorporate a 100 per cent. hot gas capacity by-pass.

A hydraulic drive is immediately attractive, since not only are the motor weight and size low, but it has been found possible to devise a control to vary the compressor speed according to the duty required from the evaporator. The function of this speed controller has been described previously (1). It should be noted that the device includes an absolute pressure reference in the form of an evacuated bellows to eliminate the effects of ambient pressure change with altitude, and maintains the evaporating pressure constant by metering the flow of hydraulic oil to the motor, thus varying its speed of rotation.

Refrigerant Migration

Whether the evaporator receives its air supply from ambient or from the engine compressor, it is the first component in the system to feel the effect of the cold ambient air at altitude. Even if engine bleed air is used, this is usually pre-cooled, using ambient air as coolant in an air/air heat exchanger, before delivery to the evaporator, since there would be an excessive evaporator cooling load at sea level if the bleed air were supplied direct. Consequently, the evaporator becomes the coldest point in the system during ascent under some conditions, such as end-of-climb, and as the cooling requirement drops to zero, the compressor ceases to rotate under the action of the motor speed controller or some other control, for example a temperature-sensitive switch which cuts out the compressor motor. The vapour may then condense in the evaporator since it is cooled to sub-zero temperatures, and if the expansion valve seat is not absolutely leak-tight, additional liquid will migrate from the warmer receiver into the evaporator. If it is also in a cold bay, there is a risk of condensation of vapour within the compressor itself.

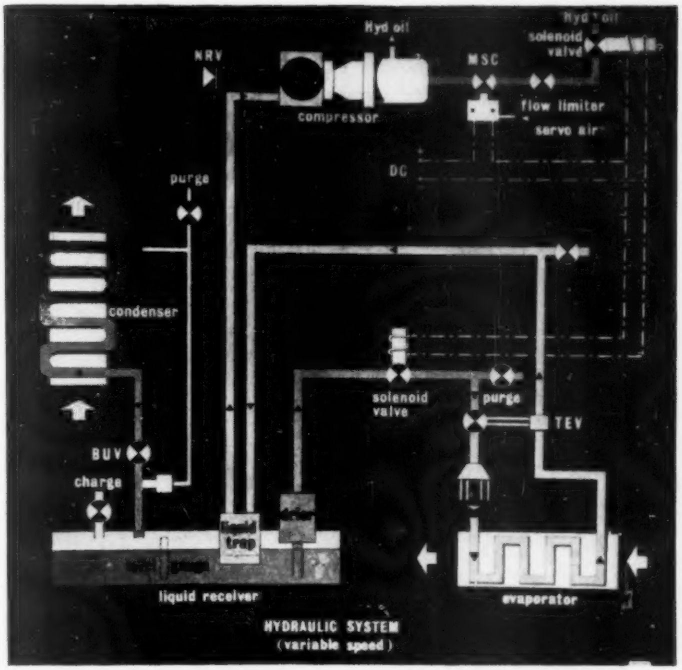


Fig. 5.

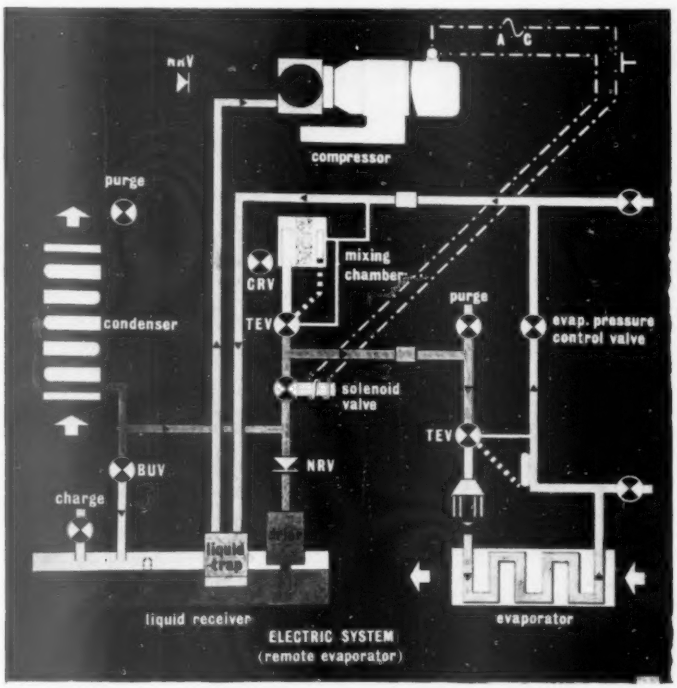


Fig. 4.

During descent, when the evaporator begins to receive hot air, the requirement for cooling generates a signal requiring the compressor to start pumping again. The immediate effect of the condensation referred to above would be that liquid is present at the suction inlet, and if the evaporator contains a large quantity of liquid, then due to the reduced surface area available for evaporation, the cooling effect will be low until the whole matrix surface area is again in use for evaporation. Meanwhile, however, during flight at altitude the temperature of the condenser coolant will have dropped, probably below zero. Thus, the condenser is at a lower pressure than the evaporator which is receiving hot air, and again, the cooling is not available when required. The effect for any condenser coolant is similar, but with air the temperature will decrease more quickly than with the fuel cooled component during ascent and will increase more

rapidly during descent.

In preventing the occurrence of liquid at compressor suction, a liquid trap situated between evaporator and compressor appears to offer an effective remedy ; this poses another problem, if the complete charge has found its way into a cold liquid trap, the system cannot start up again, and at least a small heat source must be provided to re-evaporate the liquid back into the system. Isolation of the condenser and liquid receiver, by means of a non-return and a solenoid valve, reducing the volume of vapour available for condensation and eliminating

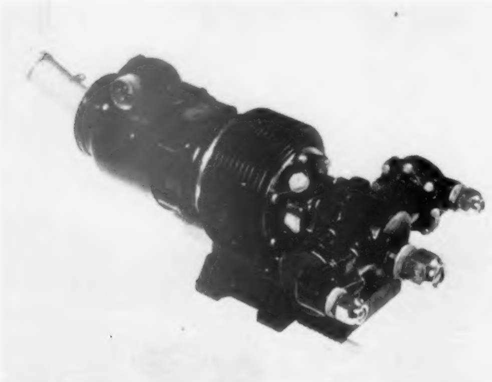


Fig. 6.—400 cycle A.C. electric motor driven reciprocating compressor, 2,500 r.p.m., oil-free operation.

migration, enables the size of the liquid trap to be substantially reduced. It is convenient to partially immerse the liquid trap in the receiver, which acts as a source of heat for re-evaporation. These two valves must be leak-tight, and capable of withstanding the high conditions of temperature and pressure.

Control of Evaporation

Due to the necessity for the refrigeration system to be able to operate during at least mild aerobatic manoeuvring, flooded evaporator arrangements have not been seriously considered, and only dry expansion evaporators have been used to date. Thermostatic expansion valve systems dependant for their operation on a bellows/phial charge of refrigerant at first appeared to be liable to lose control due to internal migration of the charge, and our first systems have been based on an adsorber arrangement ; this has not proved to be altogether satisfactory, however, due to a number of factors, including :

(i) The low rate of response of the adsorber charge.

(ii) The fact that an airborne refrigeration system rarely, if ever, reaches " steady state conditions."

(iii) The rapidly changing ambient temperature causing a reaction within the expansion valve operating system.

Professor Lorentzen, in his paper before commission III in Moscow, (2), discussed remote phial arrangement for thermostatic expansion valves when used with dry expansion evaporators, and in particular made the point that the valve can only function properly when the temperature difference between the air and the evaporating refrigerant is considerably above the nominal 5° C. normally used as a superheat setting.

If, on the airborne system, the remote phial is clamped, as is usual industrial practice, to the suction pipe, just downstream of the superheater, it is then exposed to the rapidly changing ambient temperature from +100° C. (212° F.) to -50° C. (-58° F.), over a very short period of time. Lagging the phial is clearly of little assistance ; the possibility of passing the suction pipe (with phial attached) across the evaporator air outlet face, while attractive as a solution, is rarely possible installationally. The best available solution for such a remote phial, as concluded in the above paper (2), is to heat electrically the phial by means of a heater mat controlled to a fixed phial metal temperature ; this answer, however, appears to increase the risk of internal migration in a refrigerant charged valve ; due to the rapid changes in heat loading, the switching-off of the heater mat during " off-cycle conditions " may not be applicable.

We have obtained improved control by immersing the phial in the refrigerant gas at the point where it leaves the superheater, but the response has still been too sluggish ; we have recently put in hand the design of a valve which does not use a capillary and phial, but instead the superheated gas leaving the evaporator passes through the power head of the valve around the bellows charged with refrigerant.

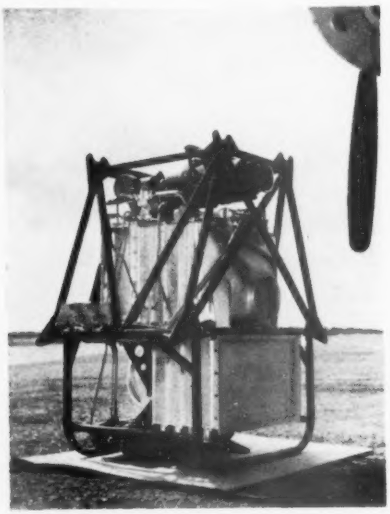


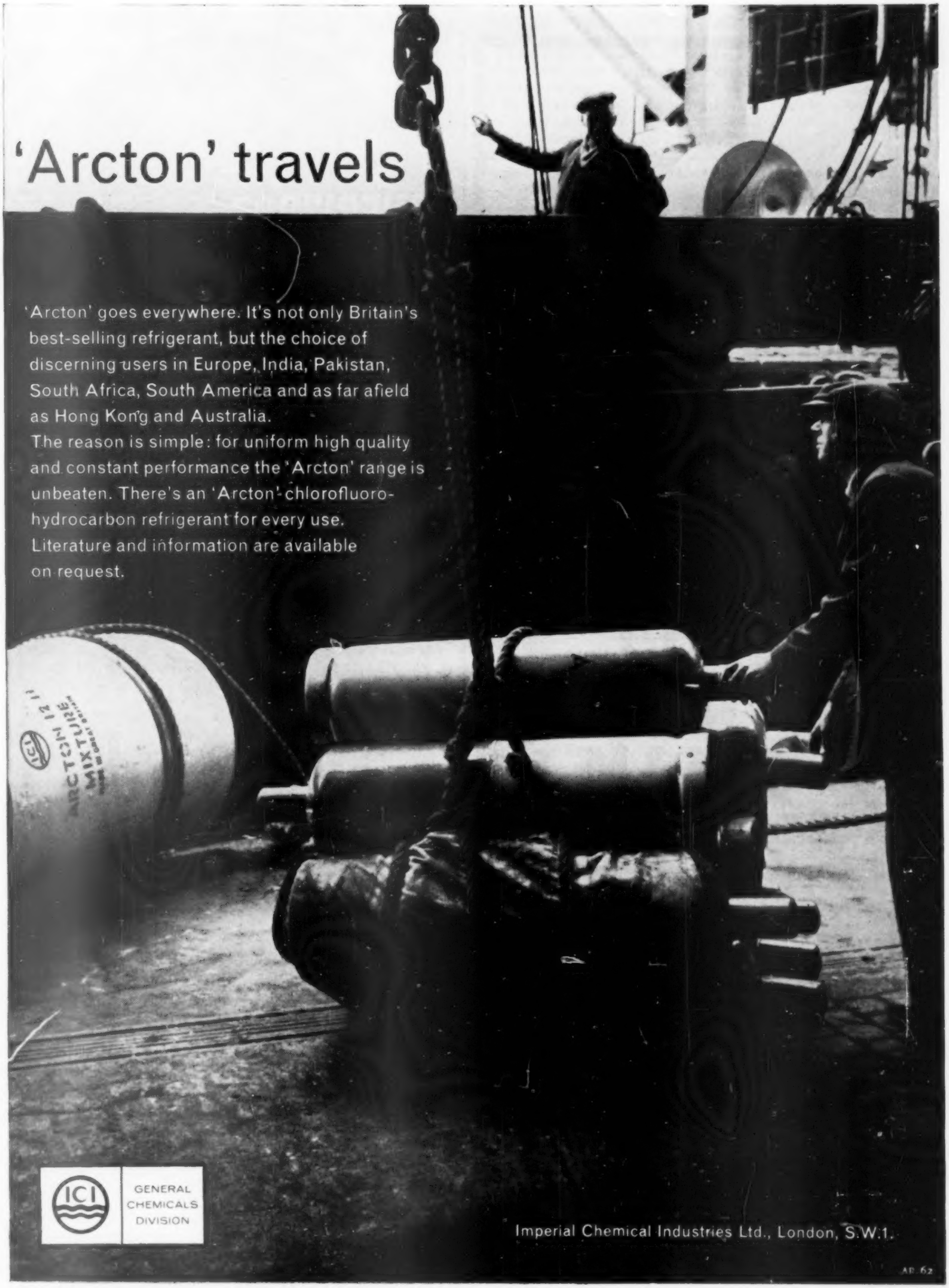
Fig. 7.—Aircraft refrigeration pack, using A.C. electric motor driven reciprocating compressor: 3,500 r.p.m. oil-free operation.

Condenser Coolants and Control of Condensing Pressure

The condensing side of the cycle creates special difficulties. As previously explained, the ram air pressure rises as the aircraft forward speed increases, and, roughly speaking, up to around Mach One the ram air may be used effectively as condenser coolant. Air cooled condensers are usually bulky, however, and the required air flow is high, often imposing an unacceptable drag on the aircraft, while a rectangular block rarely coincides with the aircraft manufacturers offered space envelope.

A very acceptable heat sink to the cooling system designer is the aircraft engine fuel. This may be used in two ways : either by placing the refrigerant condenser directly into the pipe-line between fuel tanks and engine, or alternatively employing a closed fuel circuit through the condenser.

The sub-zero ambient air temperatures at altitude reduce the pressure in the condenser and liquid receiver to such a low level that, not only is there a thermal lag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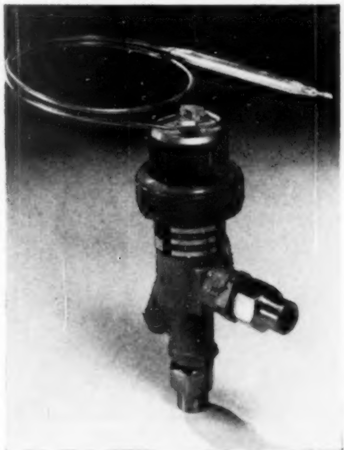
when the system is required to restart in descent, but the pressure is then so low that the thermostatic expansion valve fails to pass sufficient refrigerant to bring the system back into operation. Control of the condenser coolant flow, however, presents a number of problems, and this is particularly unpopular with the aircraft manufacturer and the user if it necessitates the addition of a control valve and/or by-pass in a fuel pipe-line.

de Havilland's capacity regulator.



de Havilland's thermostatic throttle valve.

When the condenser is air cooled, the use of a condenser air by-pass, or alternatively the incorporation of air shutters controlled by condensing pressure or temperature, appear to offer a possible solution to the problem. The air by-pass, however, involves installation of additional air ducts which would be large (and therefore unpopular on space and weight grounds) due to the large quantities of air involved. Air shutters are subject to malfunction due to clogging by ice and dirt.

One method of condensing pressure control, is the use of a valve downstream of the condenser, which closes as the condensing pressure falls to a predetermined minimum value, and backs the condensed liquid up into the condenser, thus reducing the area available for condensation, (3),

Vibration and Acceleration

The effects of vibration and high acceleration (for example, on the launching of an aircraft by catapult) make it necessary to design the components in such a manner that they are resistant to these extreme effects, both while operating and during off-cycle periods. This particularly applies to the capillary/bellows assembly on thermostatic expansion valves, and to any moving parts such as pistons in servo-operated valves which may be affected by acceleration in their direction of operation. Examples of extreme conditions such as these are indicated below :—

(*a*) up to 17 cycles per second at amplitudes :
 (i) equipment operating up to ± 0·1 in. (0·25 cm.)
 (ii) equipment not to suffer damage up to ± 0·3 in. (0·75 cm.)

(*b*) up to 2,000 cycles per second at amplitudes applicable to maintaining the following accelerations :
 (i) equipment operating up to ± 3·5 g.
 (ii) equipment not to suffer damage up to ± 8·5 g.

Our remote sensing thermostatic expansion and throttle valves have been specially designed since the capillary/bellows junction has been found to be the weakest point of such commercial valves when subjected to vibration. We have designed and manufactured servo-operated capacity regulation and back pressure valves to be insensitive to changes in ambient pressure ; the environmental temperatures which they must withstand, especially under hot soak conditions, are invariably higher than those of the air conditioned space.

Conclusion

It has been possible to describe only briefly some of the effects due to the extremes of environmental conditions which apply when we are required to apply refrigeration techniques to cooling in airborne applications. An entirely new field of application for Refrigeration equipment is opening up as a result of the more stringent requirements of the aircraft and missile fields. As has been indicated, there are many unusual problems attached to the use of airborne refrigeration components, which must endure more arduous environmental conditions with a greater reliability than is the case in the majority of commercial installations.

When we entered the refrigeration field, there were many problems which were unknown, and which differed from those encountered in industrial practice ; for this reason it has been necessary for us to devote considerable theoretical and experimental effort to their resolution. During this research, which still continues, we have appreciated the readiness with which the refrigeration industry has supplied assistance and advice, and we look forward to even greater co-operation in the future on projects which promise to be of absorbing interest, and from which we hope to contribute something which will be of use also in the more conventional applications of refrigeration.

Acknowledgments

The author acknowledges the permission of his company to publish this paper, and wishes to thank the members of the organization who assisted in its preparation.

References

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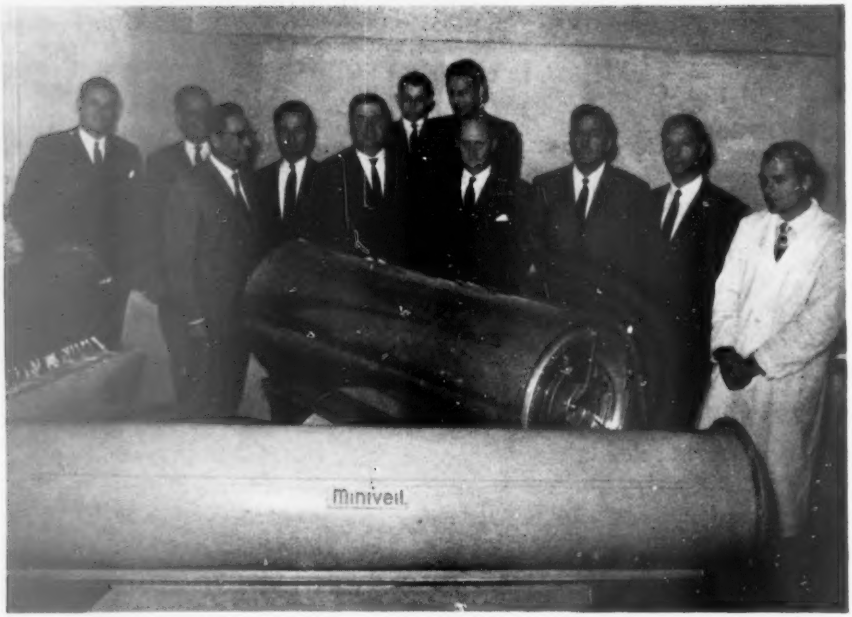

Mr. G. E. Jennings, fourth from right, seen with his international colleagues.

International Meeting of Minikay

MANY COUNTRIES REPRESENTED AT GET-TOGETHER IN SOUTHERN GERMANY

MINIKAY Limited recently held another International meeting of their Miniveil Agents. The meeting took place in the delightful town of Ravensburg/Wurtt, Germany. For those who are not familiar with Southern Germany, it may be of interest to know that Ravensburg/Wurtt is situated approximately 12 miles from Lake Constance; the nearest town on the lake being Friedrichshafen, which is not very far from Meersburg and which is one of the terminals for the Meersburg/Constance ferry into Switzerland.

From certain vantage points in Ravensburg, one can overlook the surrounding countryside which, in many respects, is very like our county of Kent. In the background on a clear day, one can see the snow covered mountains of the Swiss Alps.

An exhibition was arranged, displaying all types of Miniveil air curtains, which have been developed through the years. Particular interest centred around the latest designs, which included the new fibreglass Miniveil that was exhibited at the recent HEVAC Exhibition at Olympia. Also on display was a new design developed by the German agents that incorporated a centifugal type fan built into the main body of the Miniveil duct. A unit which also received considerable attention was the design brought out by the American agents that aims at simplicity of construction and, therefore, lends itself more readily to mass production techniques.

In the photograph, Mr. G. E. Jennings, director and general manager of Minikay Limited, is seen with his Continental and Scandinavian agents looking at the latest designs of Miniveil air curtain units.

Mr. D. Field has resigned as managing director of **Alwyn Isherwood (Refrigeration) Ltd., Leeds.** He will, however, remain on the board in an advisory capacity. This move has been occasioned by the rapid growth of Sherwood Engineering Ltd. and Mr. Field can now devote the whole of his efforts as managing director of that company. Mr. H. Robinson B.A., M.INST. M.S.M., formerly sales director, has been appointed managing director of Alwyn Isherwood (Refrigeration) Ltd. and will remain on the board of Sherwood Engineering Ltd. in an advisory capacity.

* * *

Zero Store Meeting.—A meeting of the Association of Frozen Food Stores was held in Leicester last month, when Mr. E. M. Major Lucas, of Northampton, presided. Those attending included Mr. T. Davis, Mr. R. A. Guest, Mr. F. E. R. Hooper, Mr. J. T. Newington, Mr. R. B. Serjeant, Mr. T. A. Raymond, Refrigeration Press Ltd., and Mr. A. Wagstaffe. The question of rates for the storage of oven-ready turkeys in cartons was the main topic of discussion; some members charged "per ton" and other "per carton." An analysis revealed that the rates received on these two different bases were very close indeed. An interesting visit was paid to the Leicester Pure Ice and Cold Storage Co. Ltd., which company operates a considerable capacity of zero degree space. The annual general meeting is to be held in April when it is hoped to inspect an accelerated freeze-drying plant.


L'UNITE
HERMETIQUE
S.A.
COMMERCIAL
REFRIGERATING
COMPRESSORS
AND CONDENSING UNITS
From 1/10 to 1 HP. 1.500 RPM and 3000 RPM
One phase - three phase
DOMESTIC REFRIGERATING
COMPRESSORS AND SYSTEM
From 1/14 to 1/6 HP. 1500 RPM and 3000 RPM
L'UNITÉ HERMÉTIQUE S.A.
The most important European production of refrigerating compressors in the widest range. All commercial and domestic sealed models under licence of
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Factory : LA VERPILLIÈRE - Isère - FRANCE
PERFEX 604 cm261M

HUMBER LABORATORY (*contd. from p. 1266*)

placed. Consisting of a glass tube guarded against breakage, by a plasticised P.V.C., these expendable indicators can be constructed to react at a whole range of temperatures, according to the chemicals used in their manufacture.

The principle is that a non-aqueous barrier is frozen into the middle of the tube to separate two aqueous solutions. When these solutions, which are colourless, are allowed to mix, they produce a coloured precipitate, showing that the melting point of the separating layer has been reached. To speed the mixing process a ball bearing is frozen into the layer.

Separating substances such as methyl hexyl ketone and n-decyl acetate have melting temperatures of $-6°$ F. and $+5°$ F. respectively and are therefore suitable, in cases where these temperatures are critical, for use as the separating barrier. Other substances used are n-tridecane, with a $+21°$ F. melting point, n-dodecane, at $+10°$ F. and tetralin at the bottom end of the range at $-20°$ F.

When an indicator has been activated, the colour change, which varies, of course, according to the chemicals used, corresponds to a coloured P.V.C. insert at the end of the tube. Combinations devised have included 1 per cent. nickel sulphate and 0·5 per cent. dimethylglyoxine which mix to give a red precipitate, and 1 per cent. lead acetate and 1 per cent. potassium iodide to give a yellow colouration. The solvent in each case is 50 per cent. aqueous glycol.

This device, though patented, is still new and has not, it is reported, found general acceptance in industry, although results are awaited of its use in a consignment of frozen foods in the course of shipment to the Far East.

Results from surveys conducted by both Torry and Humber laboratories illustrate the importance of maintaining constant temperatures. Cooked samples of wet cod fillets bought from fishmongers showed that fish of first-class quality constituted less than 20 per cent. of the samples examined. The average temperature of 250 packages of frozen fish covering 10 brands, purchased from " zero " cabinets, was 5° F., and quite a large proportion (20 per cent.) were above 10° F. A considerable improvement in quality would have been established, emphasised the department, if frozen fish temperatures were kept below 0° F.

Additional temperature measurement instruments on show at the laboratory included the resistance spear thermometer to give instantaneous readings of fish on board trawlers and at every stage in the distribution chain. The principle is now well known. The resistance of a fine copper wire, which forms the sensitive element in the tip of the measuring probe, changes with temperature. This resistance is measured by a wheatstone bridge and the temperature read off directly (to an accuracy of $\pm 0{\cdot}2°$ F.)

The thermocouple system of temperature measurement was referred to, but a " magic eye " potentiometer was shown, as being the most successful means of taking temperatures during road transport of frozen goods. The small current from the potentiometer was amplified sufficiently to operate a cathode-ray tuning indicator in place of the usual taut-suspension galvanometer.

The Officer-in-charge of the D.S.I.R. Humber Laboratory, Hull, Dr. Charles L. Cutting, examining a smokemeter, developed at the laboratory, and fitted to the " Torry " mechanical smoking kiln. Dr. Cutting was largely responsible for the design of this modern kiln.

Leading personalities at a recent meeting of the Refrigeration Serviceman's Association in London. From left to right: Mr. R. V. Steele, Mr. L. E. Steggel, Mr. James Douglas, president at that time, and Mr. R. D. Owen.

Modern Designs in Thermostatic Controls

WHILST it was not possible to discuss more than a small selection of the many possible control component systems available in the refrigeration and air-conditioning industries, Mr. Thomas I. Syfert, of Columbus, Ohio, sought to construct a clear picture for the combined memberships of the Institute of Refrigeration and The Refrigeration Servicemen's Association in the paper he delivered in London last month. Published here is a summary of his lecture, which was entitled " Modern Designs in Thermostatic Controls for Refrigeration, including Air-Conditioning, Automatic Defrosting and Heat Pump Applications."

Mr. T. I. Syfert.

" Control components may be grouped with reference to their function in a system as follows :—

(i) Controls for normal operation ;
(ii) Defrosting controls ;
(iii) Protective and auxiliary devices.

Controls for Normal Operation

" Compressor controls are thermostats responding as a rule to the temperature of an evaporator and cycling the compressor," said Mr. Syfert.

" Where separate defrosting controls are employed the thermostat is usually of the *fixed differential type*, i.e. a device which allows the simultaneous raising or lowering of both cut-in and cut-out temperatures by the setting of a dial knob. Another form of thermostatic control which has gained increasing acceptance for two-compartment refrigerators is the so-called *constant cut-in control*. This is a thermostat designed to allow variations of the cut-out temperature to be obtained by dial-setting, while the cut-in temperature remains constant. The cut-in setting is usually between 35° F. and 40° F. and the differential fairly wide (up to 50° F.).

" This device can be used in conventional or in forced draft refrigerators. It ensures that the evaporator cannot build up a large accumulation of frost and eliminates the need for a separate defrost control system.

" Another type control suitable for compressor cycling as well as frost removal each cycle of the compressor is the wide differential control wherein the knob setting varies both the cut-in and the cut-out, but the range of cut-in adjustment is always above approximately 34° F. This allows the user to select the cut-in setting that ensures adequate frost removal each cycle and still maintain adequate mean compartment temperature. The cost of this type control is usually less than the constant cut-in control."

Mr. Syfert described the principles by which forced draft refrigerators work, in dealing with air flow controls. The refinements he instanced included the single evaporator systems with appropriate control systems to maintain the various compartments at different temperature levels.

Thermostatic devices sense the actual air temperature at significant points and cause variations in air flow by stopping and starting a fan motor ; varying the speed of a multi-speed fan motor, or modulating the volume of air-flow by mechanical variation of the amount of opening of ducts or baffles."

As an example of control, Mr. Syfert spoke of a compressor where activity was controlled by a thermostat sensing the temperature of the fresh food compartment evaporator. In this case the compressor would be " on " or " off " without regard to the temperature prevailing in the freezer compartment. Air flow control of the freezer compartment would then be a separate means for maintaining the freezer compartment temperature.

Defrosting Controls

Means for raising the evaporator temperature above 32° F. described by the speaker included absence of refrigeration ; electric heat, from resistance heaters applied either directly to the evaporator, or used to heat the refrigerant pumped through the evaporator, and hot gas circulation, where discharge gas by-passes the condenser and is piped into the evaporator.

A fourth system referred to by Mr. Syfert was that of reverse cycle defrosting. " Whereas hot gas by-pass defrosting can only transfer a portion of the compressor motor heat losses, reverse cycle defrosting would interchange the functions of condenser and evaporator for the duration of a defrost cycle. The full heat of compression at maximum compressor capacity would be available and a greater amount of heat would be carried to the parts needing defrost and a greater vapour velocity.

" This system would appear to be the ideal thermodynamical solution and is presently used on some commercial display and storage cases. However, its introduction in domestic refrigerators awaits the appearance of a less costly reversing valve."

A press-button was the usual method of defrosting initiation, the speaker continued. Controls were available in which this merely raised the cut-in temperature of the main cycling thermostat. Other controls, similarly activated, incorporated switches to energize special defrosting devices, such as electric heaters, hot gas by-pass valves or refrigerant reversing valves. These devices were sometimes referred to as semi-automatic defrost controls.

Mr. Syfert described those automatic controls based on the counting of certain events which attempt to correlate the need for defrosting, as in the frost build-up with the intake of moisture by door opening or the addition of new and moisture-laden loads or the number of compressor cycles.

Typical examples quoted were those of door count controls, initiating a defrost cycle after perhaps 15, 30 or 60 door openings and closings ; cycle counting controls, to count compressor cycles—a process subject to many factors affecting the number of compressor cycles—and a combination of door and cycle counts.

(to be continued)

"TIME-TEMPERATURE INTEGRATOR"

ELECTRONIC research scientists of the Minneapolis-Honeywell Regulator Company in the United States have recently developed an entirely new and highly unusual device, called a time-temperature integrator, that measures and integrates time and temperature to provide a yardstick for helping to maintain quality in frozen foods. It tells the time-temperature experiences of frozen foods during various stages of handling and storage.

The miniature device operates by means of electro-chemical action. It is about the size and shape of a cigarette and weighs only a fraction of an ounce. In use, it is simply placed with packages of frozen food.

U.S. Army Quartermaster Corps, which assisted in early stages of development, had already tested 2,000 early models of the integrator with favourable results, and plans to test prototype production models soon.

The new integrator senses and records time and temperature as an integral function. The combined information is shown on a scale that is read as easily as a scale on an ordinary glass thermometer, but it does not measure food quality directly.

Instead, it produces a time-temperature exposure reading that is consistent with data compiled by the U.S. Department of Agriculture on the deterioration rates of various frozen foods at different temperatures.

This data shows that frozen food maintains quality well at low temperatures (zero degrees or below), but it becomes increasingly difficult to maintain quality at higher temperatures. Some foods that would maintain top quality for a year at zero degrees F. would suffer an appreciable quality loss in a few months at 10° or in a few days at 20°.

Devices previously available to the frozen food industry were simply temperature indicators. They indicated only that shipment may have been above zero at some time or another during shipment and storage. This information is of little value, however, without also knowing for how long the above-zero condition existed.

One of the most helpful uses of the new time-temperature indicator would be in inventory control. It can show the type of handling that foods have received, and can indicate when a laboratory quality check should be made. Also, it can be used to determine which lots of food should be moved from inventory early because of the amount of quality reserve they have left.

The new indicator is an outgrowth of three years of research in the field of electrochemistry. The integrator is being produced on a pilot basis at the company's research centre, which is making them available to the frozen food industry for experimental uses.

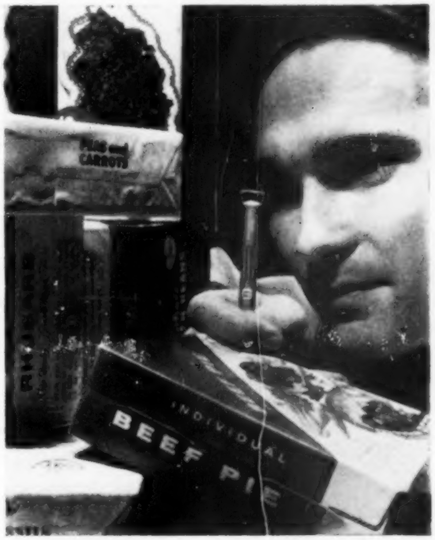
The new integrator has no moving parts, no external wiring or power sources and requires no special calculations. It is completely sealed in plastic and is durable enough to be packed right in with most frozen food packages without additional protection. After use, it is discarded.

Heart of the device is a glass tube filled with a special solution. Around the tube is wrapped a specially-treated yellow paper sleeve. At the ends of the paper are two metal electrodes of different materials and these are connected by a copper ribbon. The entire assembly is sealed in a plastic tube.

The indicator operates like a tiny electrolytic battery. To start its action, it is squeezed with a special type of pliers. This breaks the capsule of solution inside. The solution wets the yellow paper and connects the two dissimilar metal electrodes, allowing an electrochemical reaction to start.

The reaction causes the yellow paper to turn red, beginning at one electrode and moving toward the other. The speed with which this occurs is dependent on temperature. The movement is always in the same direction. Cooling to a lower temperature merely slows the movement and will not cause it to back up.

In the current model, the red zone moves the full length of the scale in about 20 days at 20° F., two months at



15° F., six months at 10° F., and more than one year at zero. Above 20° F., the indicator is designed to operate especially fast. At 25° F., the indicator will travel full scale in a couple of days.

Although the indicator is designed for initial use in the frozen food industry, it has other possible applications as a protective device for medical, pharmaceutical, chemical and other materials which are sensitive to time-temperature effects.

M. L. ENGINEERING (PLYMOUTH) LTD.

The Swedish refrigeration company, STAL Refrigeration AB, is taking a decisive step into the British market, by linking up with the British company, M.L. Engineering (Plymouth) Ltd., (MLP).

According to a recently signed agreement between STAL and MLP, the marketing of STAL's wide range of products will be split between MLP and STAL's London agent and associated company, De Laval Ljungstrom (Gt. Britain) Ltd. MLP will be responsible for all standard plant up to about 30 h.p. rating, and De Laval Ljungstrom (Gt. Britain) Ltd., for larger and special plant, as well as all factory assembled units and marine refrigeration.

MLP is in the process of setting up branch offices in various parts of the country for sales of refrigeration plant within the MLP range.

BUYERS' GUIDE

MLP will undertake in their factory at Plymouth, sub-manufacture for De Laval Ljungstrom (Gt. Britain) Ltd., and will assemble STAL units incorporating many British components including electrical equipment.

MLP will as before manufacture their range of refrigeration plants, mainly to Ministry and Armed Forces' specifications.

The addresses of M.L. Engineering (Plymouth) Ltd., 293, Leigh Road, Trading Estate, Slough, Bucks. (Tel. Slough 26244).

Factory :—Burrington Way, Honicknowle, Plymouth, Devon. (Tel. Plymouth 71226).

The address of De Laval Ljungstrom (Gt. Britain) Ltd., 129, Kingsway, London, W.C.2. (Tel. Chancery 5518).

Window Display Draws Crowds

At a cost of more than £35,000 **Edward Radio of Ealing Ltd.** has provided Ealing with its most modern electrical showroom and certainly one of the most advanced in the London area. The new premises, at 30–31, The Broadway, are on the site of the firm's original shop opened in 1947—six other branches have been opened since then. Architect Mr. L. Viner incorporated a separate feature window in the shop-front. Floored with granite and white marble it allows the regular presentation of prestige themes. First of these was an Electrolux refrigerator display using Roboto—the " live " dummy. Director Maurice Edward commented " Very effective. It certainly drew the attention and interest of the public." The display was presented in conjunction with Electrolux Ltd. A specially built washing machine display stand at the far end of the showroom enables a practical demonstration to be given of any automatic washing machine on the market. Each machine on the stand is independently spotlighted and added effect is gained by concealed, coloured lighting of the wall behind the stand, by means of an automatic colour change especially installed by Atlas lighting. An important contributing factor to the overall atmosphere of light and space in the showroom is a wall of opaque glass. This is lit from behind giving the effect of daylight.

LEVIN APPOINTMENT

Mr. B. J. Bosworth has joined Levin Refrigeration as an outside representative. Owing to the expansion of the activities of the company in the United Kingdom it has been found necessary to engage a representative whose duties will be two-fold :—(*a*) to travel throughout the country appointing refrigeration organizations as Levin distributors n those parts where they are still in need of representation. (*b*) to maintain constant liaison between the distributors and U.K. head office, assist salesmen in selling Levin Refrigeration in the field and keeping them up to date with information. Mr. Bosworth has, in fact, been intimately acquainted with Levin products since they were first introduced into this country in 1958, having been a salesman and afterwards a sales supervisor for one of the main distributors, who co-operated with Levin in releasing him for his new duties.

Mr. B. J. Bosworth.

* * *

Mr. F. C. Pullen, sales manager, Mr. G. O. Collier, works manager, and Mr. E. Walley, F.C.A., company secretary, have been appointed to the Board of **Ekco Plastics Ltd.** Mr. Pullen joined Ekco in 1941 and was appointed plastics sales manager in 1944. Mr. Collier joined Ekco in 1939 and became plastics works manager in 1947. Mr. Walley has been with Ekco since 1945 and is also chief accountant of E. K. Cole Ltd. The other directors on the board of Ekco Plastics Ltd. are Mr. E. B. Willcocks, Mr. A. W. Martin, M.B.E., and Mr. D. Radford, general manager.

PATENTS

APPLICATIONS RECEIVED

September 27—Western Electric Co. Inc., C34657, Thermoelectric refrigerators. 28—Brodrene Gram A/S. C34906, Apparatus for removing frozen bodies from freezing pockets. 29—Licentia Patent-Verwaltungs-G.m.b.H., C35192, Thermoelectric refrigerator. October 2—G.V. Ventilation, Werner, G. C35566, Method of operating air-conditioning and heating installations. 4—Clausen, M., T/A Danfoss Ved.Ing.M.Clausen, C35810, Heating and cooling systems ; Trane Co., C35814, Absorption refrigeration system. 5—Pye Ltd. Pound J.P., P35889, Apparatus for thawing of frozen foods. 11—General Motors Corporation, C36472, Refrigerators. 16—Clausen, M. T/A Danfoss Ved.Ing.M. Clausen, C37039, Motor—compressors for refrigerating machines. 23—Dunham-Bush Ltd., C37883, Refrigeration apparatus. 24—Philips' Gloelampenfabrieken N.V., C38056, Cold-gas refrigerators.

COMPLETE SPECIFICATIONS ACCEPTED

October 25—British Thermostat Co., Ltd., 884,512, Expansion valves for refrigeration apparatus ; McFarlan, A.I., 884,268, Air-conditioning system ; Stal Refrigeration A.B., 884,346, Method of refrigerating foodstuffs ; Frick Co., 884,454, Control of apparatus operating at high and low temperatures ; Svenska Flaktfabriken, A.B., 884,540, Air-conditioning unit. November 1—Bauknecht G.m.b.H., G. 885,180, Refrigerator cabinet.

New Companies

The accompanying particulars of New Companies recently registered are taken from the Daily Register compiled by Messrs. Jordan and Sons Ltd.

Refrigeration (H. & S.) Ltd., 180, Aldersgate Street, E.C.1. Secretary : M. A. Yardley. To carry on the business of manufacturers of and dealers in refrigerators, etc. Nominal capital : £100. Directors to be appointed by subscribers. Subscribers : Beryl G. Slattery, 33, Charmandean Road, Worthing ; Marietta Harper, 209, Twickenham Road, Isleworth, Middlesex.

Western Counties Refrigeration Ltd., 2, St. Andrews Road, Bridport, Dorset. Secretary : Alice R. Richardson. To take over business carried on as " Western Counties Refrigeration Company " at Bridport, etc. Nominal capital : £400. Directors : Wm. D. Davies, 24, Stoke Road, Beaminster, Dorset ; Wm. H. Richardson, Shepherds Crook, Netherbury, Dorset.

John Higgins & Co. Ltd., 32, Davenport Avenue, Manchester, 20. Secretary : Mrs. I Higgins. To carry on business of heating, ventilating and air-conditioning engineers, etc. Nominal capital £2,000. Directors : John M. Higgins and Mrs. Irene Higgins, 32, Davenport Avenue, Manchester, 20.

Display (Shop Fittings and Refrigeration) Ltd., Old Bank Buildings, Bellstone, Shrewsbury, Salop. Secretary : J. P. Ballard. Nominal capital : £2,000. Permanent directors : Peter B. Jones, 8, Raby Crescent, Shrewsbury ; John P. Ballard, 14, Priory Ridge, Longden Road, Shrewsbury ; Leo Bostock, 12, Fford Elfed, Rhosnessey, Wrexham.

Samples Brothers Ltd., Haworth's Buildings, 5 Cross Street, Manchester, 2. Secretary : W. B. Samples. To carry on business of manufacturers of and dealers in refrigerators, etc. Nominal capital : £1,000. Directors : Paul Samples, 23, Litchfield Avenue, Reddish, Stockport ; William B. Samples, 56, Claude Road, Manchester, 21.

Atlas Refrigeration (Great Britain) Ltd., 1, St. Nicholas Buildings, Newcastle upon Tyne. Secretary : K. Frosig. Nominal capital : £100. Directors : Erik Jespersen, 25, Medway Avenue, Hebburn, Co. Durham ; Andreas N. Bechman & Jens C. Holm, both of Denmark.

Refrigeration & Food Equipment Ltd., 388, Harrow Road, W.9. Secretary : Jean E. Wiscarson. Nominal capital : £1,000. Directors : Edward A. Pincott, 239, Wexham Road, Slough ; Victor T. Snook, 80, Killowen Avenue, Northolt Park ; Jean E. Wiscarson.

NEW LEC " SQUARELINE " DOMESTIC REFRIGERATORS

The first of 12 new models to be released in the new Lec range of refrigerators for 1962 are the " Squareline " domestic refrigerators incorporating all the latest features. The " Grosvenor " 7 c.ft., " Portman " 5·25, and the " Eaton " 3·5 c.ft. Ultra-modern styling with all steel shells finished in either white or cream (other colours on request) elegant chrome handles ; robust door hinges with doors opening within the width of the cabinet ; magnetic closing door gaskets which meet safety requirements ; fully insulated freezers, multi-adjustable shelves, door storage and many other extras are fitted in these new Lec models.

" **Grosvenor** " 7 c.ft. capacity. Shelf area 12 sq. ft. Price 70 gns. Height 46¾ in. Width 22¼ in. Depth 25 ins.

Special features include full-width, fast freezing, zero plus, twin freezing compartment with balanced temperature control insulated from the main storage compartment with its separate convector cooler. Automatic interior light ; matching dew-bin under shatterproof glass ; glide-away rear rollers.

" **Portman** " 5·25 c.ft. capacity. Shelf area 10·5 sq. ft. Price 49½ gns. Height 38½ in. Width 23 in. Depth 21¾ in.

Special features :—Full-width freezer and dew bin. Freezer door opens without fear of fouling refrigerator cabinet door. Door storage for bottles, eggs and packages.

" **Eaton** " 3·5 c.ft. capacity. Shelf area 6·3 sq. ft. Price 41 gns. Height 35½ in. Width 21 in. Depth 19¾ in.

Chrysler Executive Joins Airtemp Distributor

Kenneth H. Bourne, formerly area manager with Chrysler Airtemp Limited, has joined J. Raven Ltd., London distributor of Chrysler Airtemp air-conditioning and refrigeration equipment.

Mr. Bourne, who joined Chrysler in January of this year, has undergone intensive training and familiarization with the company's equipment and his move is described as "a progressive development of the Chrysler Airtemp expansion programme in the United Kingdom." Under this programme technical personnel are given the opportunity of gaining experience of Chrysler equipment by working with the company on all types of specialised installations. Eventually they are given the opportunity to transfer to distributors, bringing with them sufficient first-hand knowledge to enable them to set in motion intensive campaigns for the adaptation and marketing of the equipment.

Mr. Bourne, who joins J. Raven Ltd. as applications manager, graduated as a mechanical engineer at Guildford Technical College. From 1956 to 1958 he worked for a firm of design consultants as a design engineer concerned principally with aircraft air-conditioning systems.

He joined Alfred Porter Ltd. in 1958 and, as applications engineer, gained experience in refrigeration plant for the air-conditioning industry and in the air-conditioning process industries. From 1959 until joining Chrysler Mr. Bourne was employed by the Carrier Engineering Co. Ltd., thermal engineers, where he was senior design engineer engaged on design and application of refrigeration systems for modern air-conditioning.

Mr. W. K. Bradley, director and general manager of Chrysler Airtemp Limited and Mr. J. Raven, managing director of J. Raven Ltd., are unanimous in stating that whilst Mr. Bourne is joining the distributorship he will very much remain a member of the Chrysler Airtemp "team" in the United Kingdom.

Treatment Cuts Apple "Scald" from Cold Storage

ANNUAL losses from damage to cool-stored apples will be heavily cut by a new treatment for the disease known as scald. New Zealanders for some weeks have been eating apples preserved by the new treatment, details of which have been made public for the first time.

Superficial scald is a common skin disorder of cool-stored apples.

The New Zealand Apple and Pear Board estimates place the annual loss through this disorder in marketable fruit at a five-figure sum. The cause of the disease is not known.

Treatment with a chemical named ethoxyquin was begun in April and the supplies of apples to which this was applied have now been released for sale.

In Auckland, the tests with ethoxyquin-treated apples showed two or three per cent. severe scald and 15 per cent. slight. In untreated apples the figures were 83 per cent. severe and 16 per cent. slight.

"The results are better than we had ever hoped," said Mr. J. D. Atkinson, director of the Fruit Research Division. "Another chemical, diphenylamine, is even more effective, but we do not yet know what effect that has on health.

"Apples treated with ethoxyquin, however, have been exhaustively tested by the Health Department. The chemical is supplied only to the skin and the residues are well within allowable tolerances."

Up to now, long-keeping apples have gone into store in perfect condition in April and appeared to be in first class order when brought out five or six months later. Within a few days of removal, however, large areas of the skin may show dark brown blotches. Such apples are worthless as fresh fruit, even though the flavour is unimpaired. Most of the apple varieties are affected in this way.

In treatment the apples are placed on a conveyor belt when picked and passed through a tunnel for spraying. Eight thousand cases of Granny Smiths treated in this way last April were recently taken out of cold store and sold in Auckland.

"Astral" Price Reduction

A price reduction of 4 gn. has been made on the Morphy-Richards "Astral" A.200A. table model refrigerator. This 2 c.ft. refrigerator now retails at 31 gn., tax included. The breakdown of this new £32 11s. retail price is : net list £27 0s. 2d., purchase tax £5 0s. 9d., plus 10s. 1d. surcharge. The special set of legs converting the table model into a free-standing refrigerator continues to retail at 29s. 6d.

Mr. A. W. Sinclair, sales director of Morphy-Richards (Astral) Ltd., states : "Production of the A.200A. has now been transferred to our new Gourdie works at Dundee. Here, the additional economies of the most up-to-date and streamlined manufacturing techniques applied to large volume refrigerator production have enabled us to pass on to the general public a further saving of 4 gn. on the retail price. This price reduction brings this 2 c.ft. model into line with our lowest yet pricing structure which has been set at Gourdie by our recently introduced 3·5 c.ft. model at 42 gn. and 6·8 c.ft. model at 67 gn. At 31 gn. we are confident that the A.200 represents exceptionally good value and that demand for this well-known and popular "table model" will continue to rise at this new price which is within the means of an even wider section of the potential market."

"CARRIER"

In an article which appeared in our July issue "Carrier" was mentioned in association with the name "Westagate" in relation to frozen food cabinets. We are reminded by Carrier Engineering Company Limited, of 24 Buckingham Gate, London, S.W.1, that they are the registered proprietors in this country of the trade mark "Carrier" and that their name is widely known in the air-conditioning and refrigeration field ; they are, accordingly, the only company entitled to describe their products in Great Britain as "Carrier" air-conditioning or refrigeration equipment.

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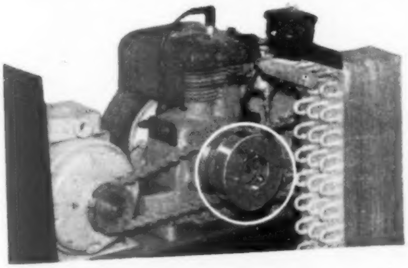

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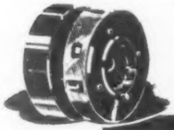

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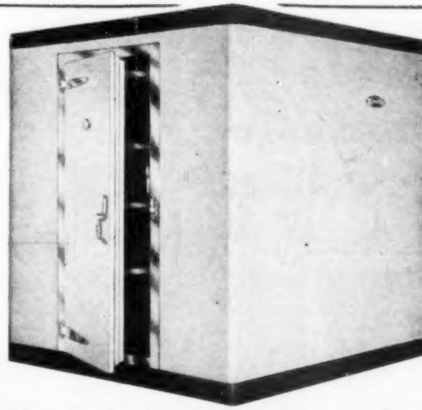

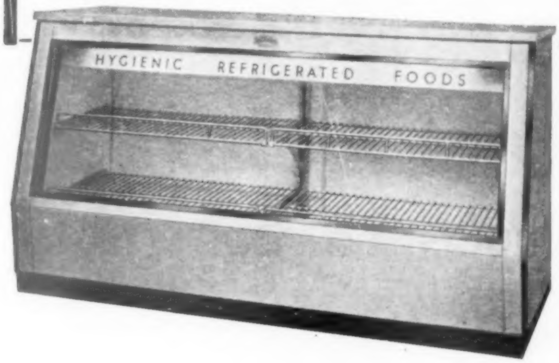

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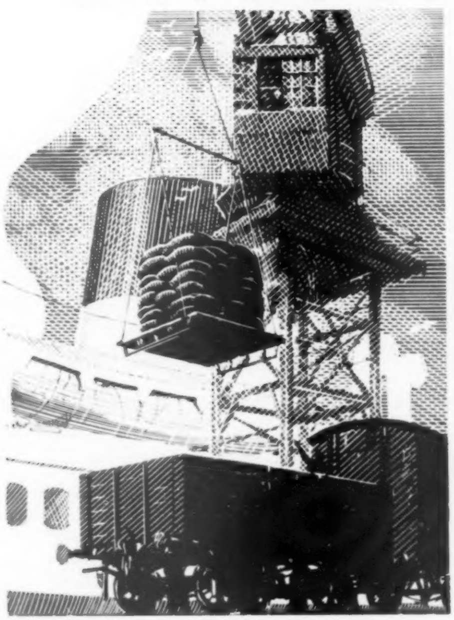

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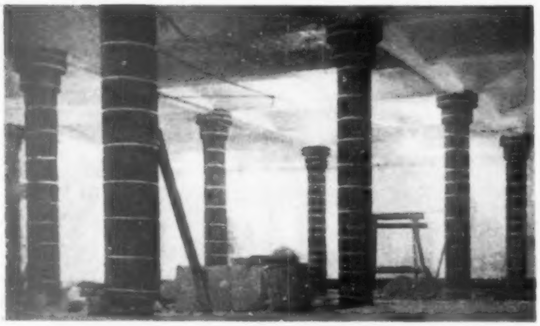

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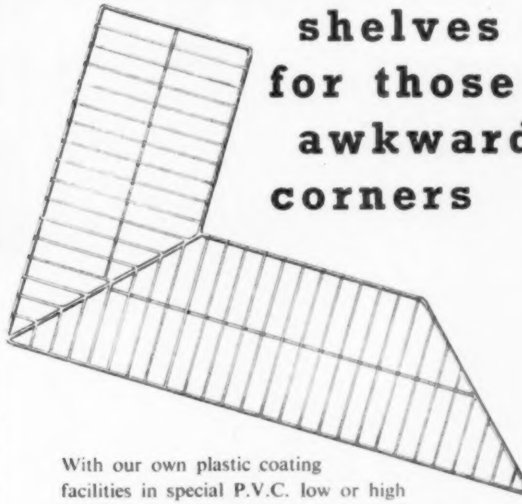

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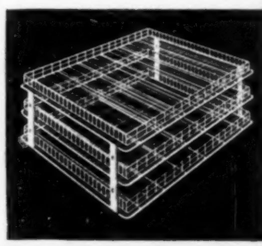

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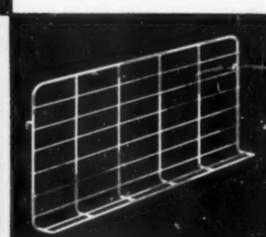

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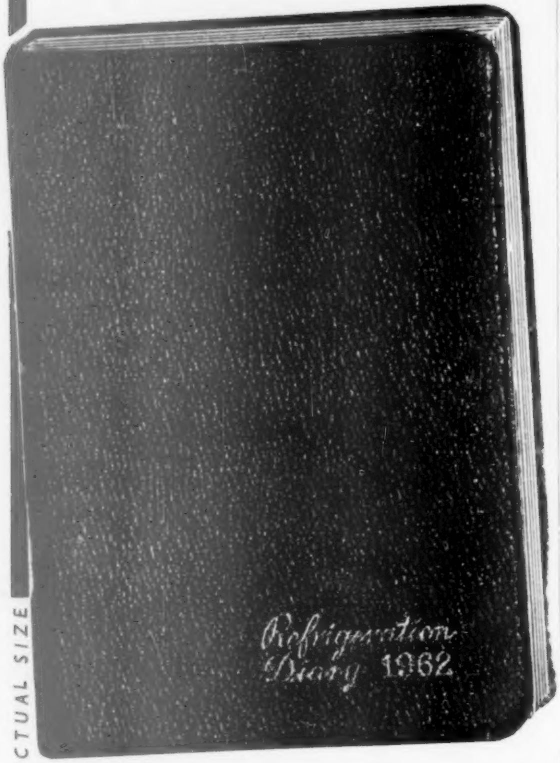

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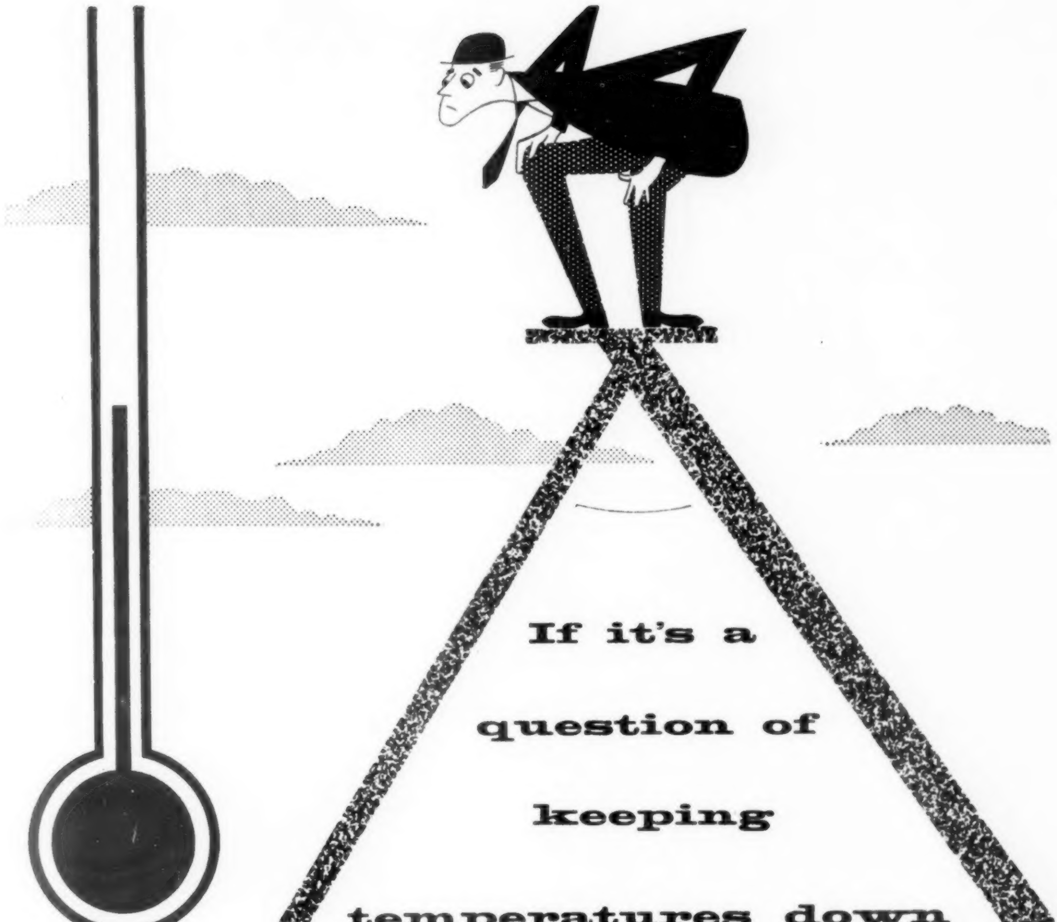

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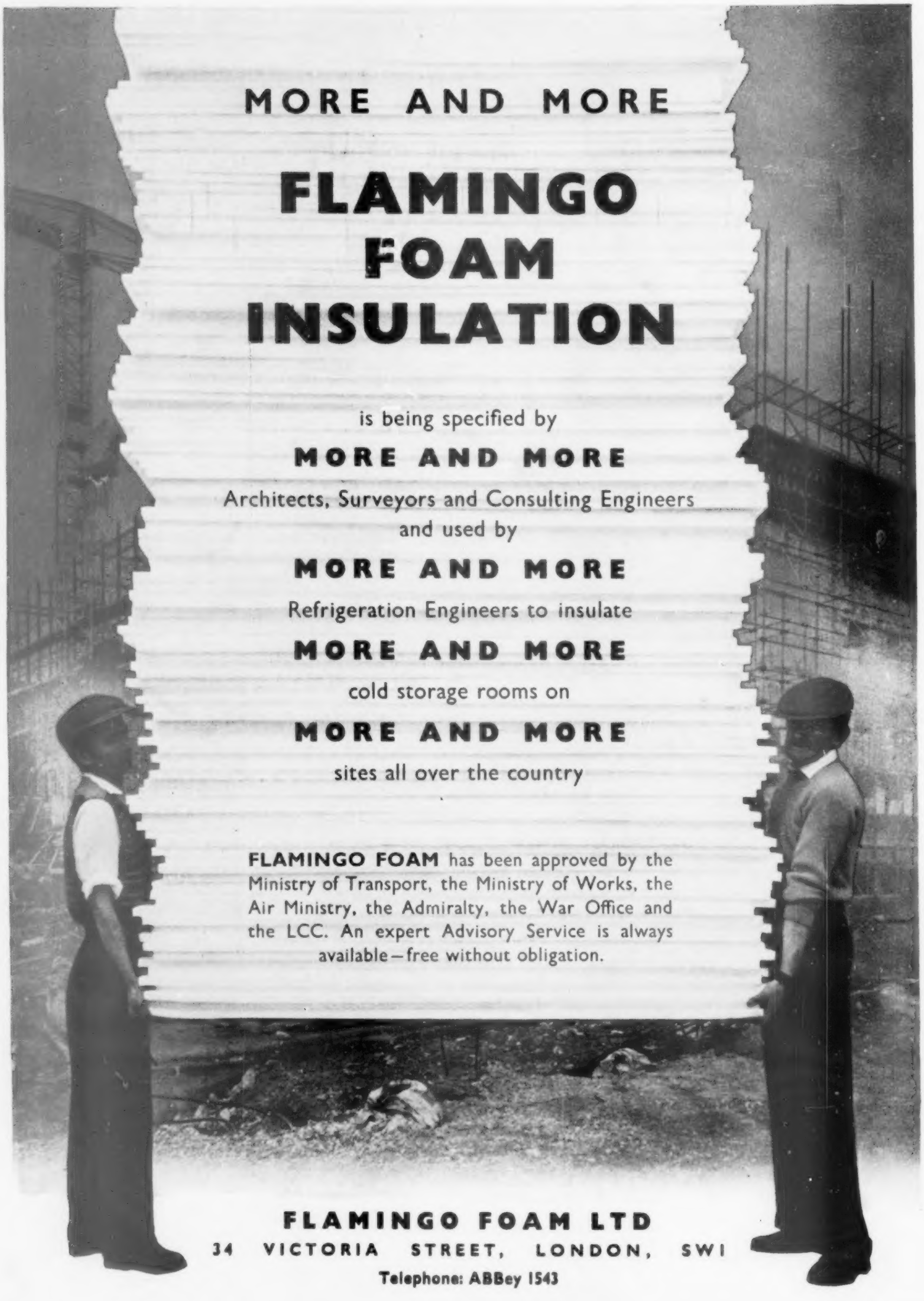

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